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THE
SANITARY HISTORY
OF THE
BRITISH ARMY IN INDIA,
PAST AND PRESENT.

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General observations.

INDIA is essentially a great military monarchy, always equipped for war, and often at war—an empire in which the army is always visible, and its health and contentment ought to be the first object of administrative care. The preservation of the British soldier's health in our various foreign possessions is a matter of paramount importance as regards our political condition, little as the subject has up to a recent date engaged the attention of our legislators.

No circumstance has so checked the progress of English rule as the maladies peculiar to tropical climates. And it is no exaggeration to affirm that a course of legislation which should effect a reduction in the high rate of mortality would more effectually secure our dominion than the most brilliant actions we have ever achieved. Not only does the expense involved in conveying troops to fill the vacancies in the unnaturally reduced legions fall heavily on the parent country, but another result, more lamentable than any pecuniary loss, invariably follows: a prestige of insalubrity hangs like a cloud over many of our colonial possessions. The soldier and the emigrant leave home with a melancholy foreboding of the probable speedy termination of their career. Hence the tropical colonies, unhappily, become too often the resort of the destitute, desperate, and the reckless. The worst features of English society are there perpetuated, with few of its excellences. This social disadvantage affects the condition of our army to an immense extent.

The great function of the British army in India, in time of peace, is to keep the peace there, and throughout a vast series of kingdoms having various races and a low state of civilisation. This has come to be the real and actual meaning of what is so often termed "our military position" in the East. The character of that position stands out at all times as the most important; and let us hope that for many years to come our white garrison may constitute but the police of civilisation and order in Asia, in the interests of its many peoples and of humanity generally.

With us war must, in a sanitary point of view, be regarded as involving trials to the moral and physical nature of the soldier, between what he can endure of hardship, exposure, fatigue, and privation, in congenial temperate climates, and what he may be trained to bear under like conditions of service in foreign and unnatural climates. Hitherto, in most of our European wars, the combined influences of ill-chosen localities for encampments, of unfavourable seasons, aided by wants of every kind—want of wholesome diet in sufficient quantity, want of clothing and tent-covering—have afforded numerous examples of the depression of the vital powers of the soldier; and hence the destructive diseases of camps, endemic and epidemic—the results of ill arrangements, ignorances and neglects on the part of governments and commanders.

If such have been, almost without exception, the health-histories of camp-life in Europe, what must have been those of our wars, and of our occupations of new countries in the East and West Indies! What even now, in a time of profound peace, and in occupation of half-civilised and ancient kingdoms, well known to us, must be the demand on the British Government in India, upon all classes of officers, civil as well as military, but especially on the medical officers of health, throughout our vast possessions there, when a great British army is to form the garrison, for peace as for war purposes!

If we are to have, in such unnatural climates, an ill-selection of grounds for temporary and permanent occupation, ill-provision in food, drink, personal covering, and general shelter, crowding, uncleanness, and defective drainage, we must, even in the absence of war, look to an amount of loss of life in our troops which may eventuate in disasters of a grave character,

both military and political. In an empire such as that of the East, it were mere weakness to suppose that at any time, even in the midst of general content and prosperity, we can afford to relax our firm healthy military grasp, or allow the moral, physical, or numerical reduction of the white hand with which we hold India.

Napoleon said that a protracted war will destroy discipline ; and it certainly destroys health also. The longer a war lasts, especially under privations, and in unfavourable climates, or when prosecuted with extreme energy, implying excessive fatigue, the physical power of the soldier is proportionately exhausted, and the sickness and mortality proportionately increased. Service in the East Indies has of late become greatly disliked by both officers and men of the home army. All the circumstances and conditions of service are unnatural, and the larger the forces employed the more is this fact felt. It is a far greater trial, even in time of peace, and extending, say, over ten years only, of the fortitude and power of endurance, of the physical stamina, and of the best discipline of the British soldier, than any person in authority at home, civil or military, has as yet contemplated ; a far greater trial, I venture to say, than would be a dozen battles such as that of Waterloo, with its active field service of a few days only.

No one at all informed on the subject can doubt that, taken all in all, and extending over a term of ten or twelve years, service, during peace, in Bengal, for instance, is a far more severe trial to the moral and physical energies, fortitude, and endurance of the British soldier than an entire lifetime, under similar conditions, in Europe.

The question of the proper disposal, and of the proportionate force, European and native, of the garrison of India, is matter of imperial importance ; but as yet the public is not cognisant of the views of our statesmen and commanders on this vast and vital subject. I venture to say that health considerations ought to have a large share in the determination.

Remarks on Army Medical Statistics.

1. In former times, military medical statistics, such as they were, and when anyone could be induced to examine them,

were, in effect, but a loose and barren record of mortality, leading to no practical result of any kind in favour of the British soldier, wherever he may have served.

2. In the East and West Indies it was known that a march into a deadly jungle or swamp, ordered at the most deadly season of the year, in the hottest hour of the day, under no provision or precaution of any kind, and resulting in the speedy destruction of half a division, brigade, regiment, or detachment, suggested to "the authorities" nothing more than that the loss had been a necessity, an effect of climate merely—a matter inevitable, in fact. For the rest, so many casualties had to be filled up from home, by recruiting: and here ended the question.

3. None of the causes of destruction of life, and of the health of the survivors, whether natural or artificial, were known, or even thought of; death was regarded as an ultimate fact, beyond which there was no occasion to proceed. There was, then, not so much as that half-knowledge which, applied to our military arrangements in peace and in war, has so often brought ruin on our expeditions and our campaigns.

4. It cannot be too much, or too often, impressed on our statesmen and commanders, that everything in the life of the soldier, physical, moral, social, and military, must be thoroughly examined and ascertained, in order that the causes of his decline in health, at the earliest and most remediable stage, may be justly appreciated; half-knowledge can but lead to confusion and loss of every kind. Facts of unexpected discovery may sometimes overcome our confidence in very low estimates of mortality in some of our tropical possessions.

5. In more recent times, and chiefly through the admirable statistical researches and records, originating with Henry Marshall, Major-General Sir Alexander Tulloch, and conducted of later years by my friend, Dr. Graham Balfour, the ratio of sickness and of mortality, and the nature of the diseases prevalent in the United Kingdom, and throughout our foreign possessions, have been accurately noted; yet, whoever is conversant with the prevailing modes of conducting business in military offices must be aware that mortality alone is what executive officers of all ranks look to with most attention; almost, indeed, to the exclusion of other and most important concerns.

6. What may be the proportionate numbers per 1000 to be invalidated annually in India, together with the consequences to health and to life of such invaliding, within a year or so after the return home of the sick soldier, must always be matter of great importance; and both will depend, even in time of peace, on the nature of the localities and of the seasons to which the soldier had been exposed in India. To estimate aright the efficiency and power of our army in the East, a great deal more than the list of casualties must be consulted and carefully weighed.

7. There are in all tropical climates diseases which are seldom or never fatal, but which nevertheless occasion a large amount of present inefficiency in troops, and eventual loss of life, more or less remote.

8. With the labour recently bestowed on military medical statistics, we are still wanting in information as to the health-rate and the life-rate of the soldier, under the various climatic influences to which he is exposed. Tables exhibiting the absolute proportional rates of sickness and mortality may afford a theoretical estimate, or computation, of the influence of any given climate or locality in producing disease and death; but they leave unnoticed the condition of health, the fitness for service,—the life-rate, in short, of the large marching mass of the troops. The soldiers who are not reported sick are too much presumed, officially, to be well, which in all our tropical possessions is far indeed from being generally the case. A history of health would prove of great value, a value equal at least to that of disease. Amongst organised bodies of men, as seamen and soldiers especially, facts and circumstances affecting health, in relation to causes under our control, must always prove of incalculable value.

9. This most valuable information, so inestimable to the statesman and the commander, has only to be called for to be furnished. When placed before the authorities in accurate detail, it will never mislead, either as to the influence of a given climate, or other circumstance, on health, or as to the numbers actually fit for duty in the field. For want of such reliable information, I have seen regiments with so many men falling out on the first day's march as to cause much distress and delay to the healthy and serviceable soldiers; and it has

been notorious in India in all times that regiments have been selected for field service which were hardly fit for the duties of the cantonment; the selection being made on grounds which could not at the time be defended. This kind of selection occurred, too, when regiments in stout marching order were close at hand.

10. While a just attention is due to the subjects of proportionate sickness and mortality, an equal attention, at least, is due to a consideration of the physiological actions of strange climates, and of the consequent alterations in the health and vigour of the troops; and this is the more necessary, as British soldiers are liable to be removed suddenly from one country to another, and to be thus exposed in rapid succession to every climate known to us. If it be necessary to have sick reports, we ought likewise to have accurately-prepared health-reports; and they should be placed before those in command in time of peace, at the end of every quarter of the year at least, and in time of war once at the end of every month at least. There can be no difficulty in measuring the standard of physical vigour prevailing amongst men borne on the musters. All that is required for the duty is a really good medical officer.

11. The annual reports of regimental and staff medical officers should for the future deal more than hitherto with the numbers and condition of sound men, and more particularly with details of such circumstances as may have occurred in given times and places, so as to complete the health history of each regiment for the year.

12. Two regiments shall serve during two years at two stations in India, each noted for peculiar heat of climate. They shall both exhibit a very low rate of sickness, invaliding, and mortality; and satisfaction will be felt in the offices of adjutant-general and commander-in-chief. But at the end of the short term of two years, such corps will be found unfit for active field service, through the exhausting effects of heat alone, or of heat and moisture conjoined. The fact is familiar to many who have served long in India or Burmah.

13. To illustrate practically what is here submitted for the consideration of army surgeons, I will adduce the health-history of the 69th Regiment, after a service of about three years

at Tonghoo, in Pegu, as related by the late and much lamented Dr. Macpherson, Inspector-general, Madras army:—“The death-rate,” he says, “is surprisingly low; the average daily sick for the year was 69, out of a strength of 964 men, or about 7 per cent.”

14. The appearance of the men when paraded for inspection, was “bloodless and anæmic, with soft relaxed muscular tissue, pale lips, tongue, and gums, and a low state of circulation.” They were pale, waxy, and blanched in aspect, complained much of want of energy, and expressed an eager desire “to be removed from Tonghoo.” A governor or a commander-in-chief issuing his orders from the head-quarters at Calcutta, Madras, or Bombay, might well be excused, judging from the “Returns,” for ordering such a regiment on active field service in Burmah or elsewhere. The results of such arrangement might cause the loss of a battle,—nay, the loss of an army.

15. There were here assembled causes more than sufficient to produce a scorbutic taint in the soldiers: a heavy, humid, warm atmosphere; sameness of diet; an insufficiency of fruits and vegetables; an extreme monotony in habit of life; mental and bodily inertness; mental depression, and a too long residence in one station. In Eastern phrase, What more need I say?

16. Looking to the climate of Burmah, in which I served in the two campaigns of the first war in that country, and to the health-history of the British garrison there, from the earliest date of our acquaintance with it to the present day; looking also to the state of health of numbers of our officers who come home every year from Pegu and Ava, I feel assured that the 69th Regt., at the time here referred to, was suffering from latent scurvy, and that an earlier report of its health-condition might have saved it from cruel suffering, and restored it speedily to a state of efficiency. For the future, more consideration must be given to health-returns in our system of reporting.

17. Two voyages, just before entering on service in Pegu, during which salted meat and biscuit must have formed the chief diet, ought to have saved this regiment from service in such a climate. Before embarkation for India it had recently returned from a long service in the West Indies, proceeding at once to Burmah, and tasting there nothing but coarse beef and

other commissariat rations during three years. The men looked as if they would speedily succumb to any epidemic influence, or break down on an ordinary march. This fine corps was extinct, morally and physically, for any purpose of war; yet all this time it will, I dare say, be found, on honest inquiry, to have been borne on the "effective list" of the British army.

18. Certain districts and stations in India having a great rain-fall, as the Malabar coast, Assam, Burmah, &c., have been found, even after brief occupation by British troops, to induce æmemic forms of disease; and when errors in diet have been added, scorbutic affections have frequently resulted. Even in some stations in India, in the plains as well as on the hills, scorbutus has been found to prevail, mostly during the rainy season.

19. But the climate of Burmah has a bad pre-eminence in this respect. Mr. Taylor, Inspector-general, reporting on the health of the 80th Regt., says that "morbid states of the constitution were declared in the physical condition of the men from the time of the capture of Rangoon. It was marked by a very pallid, soddened appearance of the face and a pale leaden hue of the lips, rapid emaciation, and an unquenchable thirst. Frequently the gums were observed to be in a scorbutic state, and even among the officers there were few in whom these indications of morbid wear and tear of the system were not apparent. To many, both officers and men, this morbid condition gave a worn and aged look." Let the military estimate of this regiment's efficiency at this time (the second Burmese war) be consulted, and let the facts be declared.

20. It was observed of three regiments, while serving in China in the last war, and which had been some years previously at the Cape of Good Hope, that they furnished an undue proportion of sickness and mortality as compared with other battalions coming direct from England; so that the semi-tropical climate of Southern Africa would so far appear to secure no acclimation for employment in India. The life-rate of these regiments from the Cape, on leaving the colony, would have been of much interest if carefully recorded.

21. The notion that Gibraltar and Bermuda possessed climates capable of preparing British soldiers for service in our various tropical possessions was formerly entertained; but

the result has proved, on trial, almost always unsatisfactory.

22. The life-rate of the 74th Highlanders, had the previous sanitary history of the regiment received consideration, must have secured for it, on landing in India, more careful attention than it received. Tables of sickness and of mortality may have been well looked to in the gross in South Africa, but practically, everything else had been overlooked.

23. The corps on its arrival in India was suffering from the effects of hardships, exposure, and privation during three years' active service in the semi-tropical climate of the Cape of Good Hope.

24. On this service, and during the voyage to India, the men were generally without vegetables; "often dieted on biscuit and salt provisions alone." Such volunteers as joined the 74th from regiments then leaving India had been seriously injured in their health and constitution by residence on the Western or Malabar coast; the two classes, when united, forming thus a body of diseased men.

25. It was now found that a certain portion of the 74th had acquired at the Cape "a highly scorbutic tendency," and that of the volunteers from the 25th and 94th Regiments many had suffered from "a virulent and fatal form of dysentery, causing no less than eleven casualties out of between twenty and thirty cases."

26. Soldiers thus circumstanced were marched to the Nielgherry Hills, Wellington Station, without any previous inspection, parade, or medical examination, having in view to ascertain the fitness of the men, or otherwise, to meet so great a change of climate.

27. It is hardly possible to conceive any circumstances of previous constitutional ill-health more unfavourable to troops about to be sent into the cold and damp of any of the higher mountain stations of India than those briefly detailed; but the local conditions presented on the arrival of the troops in the hills were no less adverse to them.

28. They were placed, some in portions of a barrack which had been but recently built, while others occupied low damp huts, having insufficient bedding and clothing. All were

alike more or less diseased in constitution,* and all were greatly overcrowded.

29. The question, then, of the more or less steadily progressive degradation of the European constitution, in the case of the soldier when serving on the plains of India, in strict accordance with, and relation to, his length of service there, is what demands the greatest attention. His sickness, mortality, and invaliding, have indeed been well counted; but such reckonings have nowhere shown us what have been the peculiar damaging influences in particular districts and stations as compared with others, say of higher or lower elevation, or of different geological character within given terms of residence. This has been almost impossible in the case of the Royal Army from the constant change of station of the troops. It might have been worked out in the East India Company's European regiments.

30. But the progress in sanitary arrangements now taking place in India, through the impulse there imparted by the recommendations of the Royal Commission of 1859, of which I was a member, is a marked and important event in our imperial history. The annual death-rate of British soldiers in India, during sixty-four years, was 69 per 1000; and this rate is now in progress of reduction towards the anticipations of the Commissioners, in their report to the Queen, or to nearly one-third of its former amount; and still greater improvements are in promise.

31. Under the old death-rate, and with the increasing reluctance to recruiting (not to speak of political contingencies in Europe), it would be most difficult to get up or maintain in India a sufficient British force to hold possession. In any case, our retention of our Eastern empire must depend greatly on the progress and practical application of sanitary science.

32. Even at home, in far-advanced England, our progress has reached only to midway in the saving of health and of life; and this much is practically known by those only who are conversant with the subject. We are, indeed, everywhere

* How men from the 25th and 94th Regiments, in the miserable state of ill-health described in the Reports, came to be received as volunteers into the 64th Highlanders, does not appear; but volunteers have usually been examined by a Medical Board, and been reported fit to serve.

reminded that the science which takes care of health is only in its infancy. It is a new arm of the public service, civil as well as military.

33. In no other country is it so easy to count in men and money the disastrous differences between an army lost, and the gain of an army saved. In the former order our experiences all over the world are unbounded ; but China alone has witnessed, within the last few years, our complete success in the care of the soldier's health. The sanitary arrangements in our last campaign in that country were more of Lord Herbert's ordering, and they were, I repeat, complete.

34. Notwithstanding protests innumerable, extending over the official lives of the old surgeons of our fleets and armies, the entire organisation of our medical departments was, up to the late war with Russia, solely directed to the alleviation of sickness and wounds,—of the “sick and hurt,” as they were termed. Not a chapter, not a word, obtained a place in our “Regulations,” by way of instruction for the young surgeons in the science of prevention of disease, endemic and epidemic; indeed, the old surgeons of the sea and land forces had too often to acquire such practical knowledge as they could attain to, at the expense of the seamen and soldiers under their care.

35. If we are to retain our hold of India to any good purpose, we must have the climate and the people, as far as may be, on our side; the cause of health and the cause of good government being one. Neither must the strength of the British garrison there be counted by the muster-rolls, but by its soundness in health, and consequent real efficiency in moral and sanitary aspect,—the moral power in armies being, according to Napoleon, as two to one compared to the physical power.

Health-history of the British Army in India, 1800–1856.

I propose here to offer, for the consideration of medical officers serving in the East Indies, some of the important results arrived at by the Royal Commissioners* appointed in May,

* The Report to the Queen is mainly quoted; but the letter of Lord Stanley to Sir Charles Wood, and that by the Sanitary Commission, War Office, to the same address, have also been referred to.

1859, "to inquire, firstly, into the rate of sickness and mortality, and invaliding, among our troops, both of the general and Indian armies, in all the stations throughout India and its dependencies, and into the class of diseases from which such sickness and mortality arise." And, further, as to "the causes of sickness and mortality, whether as relates to climate, locality, state of barracks, drainage, water-supply, diet, drink, dress, duties, or habits of the troops." Further, the Commissioners were ordered by the Queen to inquire "what existing stations are unhealthy, and to indicate how such unhealthiness may be removed, if possible, and the nature of the sanitary improvements required; the subject of healthy positions generally, with the view of recommending the most healthy for future occupation, and of ascertaining whether healthy stations may not be found within moderate distance of such unhealthy stations as may be of political or military importance."

The last of those higher subjects ordered for investigation by the Commission was the most important of all—viz., "the general subject of sanatoria and hill stations, with the view of pointing out the most healthy positions on them." Supplementary to these cardinal subjects, we were ordered to inquire in detail into—

1. "The best construction of barracks and hospitals, huts and tents, for India.

2. "The present regulations or practice for preserving the health of the troops, and enforcing medical and sanitary police.

3. "The organisation of the army sanitary service.

4. "The practicability of establishing a general system of military statistics throughout India, and to ascertain whether any and what means exist of comparing the diseases and mortality of the troops with those of the civil population, British and native.

5. "And we do further command and require you to report what changes you may consider it expedient to make in the present practice, with respect to any of the subjects above mentioned."

6. The questions ordered by her Majesty to be examined and reported on occupied the Commissioners from May, 1859, to the same month in 1863; thus their labours extended over four years, and were conducted alike in India and at home.

7. How the duty has been performed it would not become me to say; but the first of British medical periodicals has declared that "From the very wide extent and varied nature of the field of inquiry, as well as from the comprehensive and searching system of investigation pursued, and the highly intelligent character of the testimony received, whether orally or in writing, an amount of valuable information on many of the most important subjects relating to public health is collected together, such as has never before been obtained. The appearance of this Report, with its documentary evidence, will form an era in the literature of State Medicine and of hygiene, not of armies and military establishments only, but of communities and peoples also."*

8. However this may be, the history of British military health, as presented in the Report of the Royal Commission, must long remain an important subject of reference, and a warning, to the army surgeon, wherever serving.

9. The task of maintaining the British army in India is not light, and can only be achieved in field and cantonment by the most sedulous vigilance, in combination with scientific and administrative ability of the highest order; something in its accomplishment always depending on the officers and men themselves. The Royal Commission collected evidence, analysed observations, and embodied the recommendations in their Report, of the most eminent Indian and other authorities, including two members of the then Government of India.

10. The Government knows that, even in war, efficiency in the field is the supreme test of an army's sanitary organisation. This fact was proved, to the credit of the Indian Government, in the Affghan, the Sikh, and the last China wars, and to its great discredit in the first Burmese and first China wars.

11. But it is necessary to look back to the past of the British army in India, and the following are some of the results presented by the Commissioners:—

Mortality.

12. To render medical statistics available for comparison or other useful purposes, two conditions are always necessary—a

* British and Foreign Medico-Chirurgical Review, Jan. 1864.

wide range of observation in years, and large masses of men. These two indispensable advantages, sufficiently long to furnish just averages, were freely available by the Royal Commission—first, towards obtaining the most important information, and, eventually, for securing to the British soldier in India the most beneficent results.

13. The Report of the Commission discusses, generally, the sanitary question as regards the whole of India, its sickness, mortality, invaliding, &c., during fifty-seven years. Information on these points was sought for down to the latest dates, but nothing was found at the India Office later than 1856.

14. The mortality, deduced from the latest War Office returns which Sir Alexander Tulloch could give in, closely agreed with the mortality deduced by the Commission from still better materials—the Nominal Returns of the Company's European troops. By the one the mortality of British troops in India was 70, by the other 69, in 1000.

15. The soldiers who were invalided from the Royal army and from the Company's forces included many who suffered under slow fatal diseases, such as chronic diseases, the results of fevers and dysenteries, which were contracted on service. The Commission did not bring them into account; yet the returns showed that, while the annual deaths during fifty-seven years were, for all India, at the average rate of 69 in 1000, the other casualties were 82 in 1000; making the total casualties from all causes, including invaliding and discharges, 151 in 1000. The Commission brought only 69 per 1000 into prominent and immediate account.

16. The question of the effects of war was discussed in a separate chapter, and it was shown that the years of war were those in which the mortality was generally highest, but that the greatest part of this mortality was the direct effect of fevers, dysenteries, cholera, &c., leaving but a small proportion as resulting from deaths in battle and from wounds.

17. It is evident that the mortality of an army in war cannot be omitted in any investigation of the general mortality to which it is liable; and it is in war chiefly that the deficiency of sanitary arrangements is seen. Thus, as it would not be right to leave out the years of the Crimean war in investigating the aggregate mortality of the British army, neither could the

Commission exclude the years of war in India from their survey.

18. The Commission did not include the years of the Persian war or of the mutiny; for, imperfect as the returns in their possession were, the returns of the commanding officers of regiments, published in detail in the folio report, convinced the Commission that, had the returns been brought down to the latest period, the rate of mortality would not have been lowered by that operation. But in any case the Commission would not have been justified in basing its calculations upon a future of unbroken peace in Asia.

19. That the rate of mortality would not have been lessened in the Report by including the latest period is evident in a published table, by which it appears that the deaths in Persia were in the military year ending April 1st, 1857—

64th Regiment	...	...	...	...	237 men
70th	„	...	...	...	117 „
60th	„	1st Batt.	...	...	194 „
81st	„	...	...	...	170 „

And other regiments lost greater numbers. In the following year twelve regiments lost—

105	384	223	280	128	175
107	106	228	284	140	121,

out of strengths often below 1000 at the beginning of the year.

In the military year following (1859) seventeen regiments lost in India—

116	187	107	104	120	123
118	113	141	176	123	139
112	112	165	141	148	

And of other regiments the losses were very heavy.

After the war, the invalids and disabled, many of whom died, were sent home in large numbers, and thus reduced the deaths in India during the following years; meanwhile, the mortality of the above regiments during the four years 1857-60 was at the rate of 77 in 1000.

20. These regimental returns will be of use to the future historian of the war of the mutiny; but the Commission, desiring to avoid anything like over-statement of the ease, did not bring the mortality of any regiment during the years 1857, '8, and '9 into account.

21. The reduced mortality which has come to light since the inquiries of the Commission commenced, is cited by a certain class of writers to prove that the Commission, in their Report, overstated the deplorable mortality which prevailed during the present century, down to the year of the mutiny. Other critics, by excluding years of war, as well as even deaths from cholera, and selecting years after war had cleared the army of its invalids, contrived to exhibit low rates of mortality, but now have impeached the accuracy of the calculations of the Commissioners. The mortality which the Commission cites is indeed an incontestable fact.

22. The suggestions of one writer that, to reduce the mortality of the army in India the sole course is to avoid war in future, requires no comment or discussion.

23. With regard to recent lower death-rates, it is necessary to bear in mind that numerical records made for short periods (still more for a single year) are usually either in excess or in deficiency; and no general law, either as regards sickness or mortality, can be deduced from them. By selecting particular years, all the stations, even on the West Coast of Africa, might be shown to be among the healthiest places in our foreign possessions.

24. It is always possible, by selecting years, short periods, and localities skilfully, to prove that the mortality of the troops in a great country is either high or low; but averages deduced from short periods can never be just. The Commission was well aware of this, and, to avoid all such misleading fallacies, based their estimates on returns during a long series of fifty-seven years, displaying, however, the facts for each year and for each Presidency. The Commission not only described the mortality of each Presidency separately, but, as far as was practicable, of each station, each regiment, and each arm of the service.

25. So far as the Commission could discern, there was less disposition among Indiau authorities to believe that the mortality of European troops had been high, particularly during active service, than to admit that the mortality could possibly be reduced below the past standard; it was all the fault of the burning, implacable sun, according to popular belief. The Commission addressed itself, therefore, especially to this branch of the inquiry, and proved—

a. That in several of the hottest stations in India the mortality had been as low as 30 and 20 in 1000 during a series of years.

b. That the mortality was everywhere mainly due to certain diseases which are the result of various excremental organic compounds and marsh malaria, producing the same class of diseases in Europe.

c. That the mortality of the population from the same class of diseases was formerly higher in London than it is now in Calcutta.

d. That the dietary, regimen, barracks, sanitary arrangements, particularly in the field, had been inconceivably defective during a long series of years.

e. That the native cities and bazaars of India were in a deplorable sanitary condition; that they were centres of disease, but that the native troops lost less than 20 per 1000 by death.

f. That the military officers of the Company died at the rate of 31 in 1000, while the civil servants exposed to the same climate died at the rate of 20 in 1000.

26. All this seemed to show that if British soldiers died at the rate of 69, or even 50 per 1000 annually, it was not the uncontrollable "climate" that killed them.

27. From these and other elaborate inquiries, the Commission concluded that the "climate" of India includes various elements, and that the mortality of our army and of the European race is due chiefly to those elements which are, to a large extent, under control. The diet and clothing of the men could be improved; the excessive doses of poisonous spirits under a burning sun could be commuted into other drinks; the mind of the soldier could be occupied; troops could be transferred from stations irreclaimably bad to stations proved by experience to be comparatively salubrious, and susceptible of being rendered more salubrious still. The same sanitary measures, too, as had driven plague from Europe, and mitigated malarious fevers, must, it was inferred, produce the same salutary effects in Bombay, Madras, and Calcutta, and in other cities of India.

28. The first great fact which struck the Royal Commission forcibly was this: The civil servants of the Company at the soldier's age did not die at a rate higher than 20 in 1000; and

as they are distributed over all the country, it follows that the climate of India is not necessarily fatal to any higher proportion.

29. The mortality of the military officers who were stationed with the British and native troops all over India had been as high as 38; but it had been less by 31 than the mortality of the European soldiers. The mortality of British soldiers at many stations did not exceed 20 per 1000, and half of this was by diseases resulting from defective sanitary arrangements. The mortality of the native troops did not exceed 20 in 1000 under many unfavourable conditions, and the mortality of Indian cities was not higher apparently than that of European cities in the same unhealthy condition.

30. In the seventeenth century London, chiefly in the summer and autumn, suffered from the same diseases as Calcutta—fever, dysentery, cholera, the plague occasionally in addition.

31. Referring now more especially to the Report, I proceed to show what has been the rate of mortality, and the effect of this on the efficiency and on the cost of the British army in India.

32. The medical reports, special investigations of the casualty-rolls which I have had made, and a great variety of returns, supply the materials for determining the mortality of the European non-commissioned officers and men in the various arms and in the three Presidencies.

33. In the spirit of providence, the civil and military officers of the late Company established funds for the sustenance of widows and orphans; but generally without sufficient data: hence it has been necessary to submit their experience to the investigation of several actuaries in London, who have at various periods reported on the mortality of Indian civil servants, of military officers, of wives, widows and children. From another source we are able to follow the Indian officer home, and to determine his lifetime after passing through the perils of India. With the non-commissioned officers and men we can now, for the first time, deal in the same way.

34. The variations of the rate of mortality among men depend on two great classes of causes: the first class inherent in the organisation itself; the second external.

35. Sex, and perhaps race, as well as age, are other inherent elements affecting the rate of mortality. Each age and sex is subject to a mortality which may be called natural in the present state of mankind; but that natural mortality is everywhere augmented by bad habits and unfavourable conditions. The natural standard is therefore undetermined; but the ascertained rates of mortality actually prevailing among large bodies of men will serve temporarily all the practical purposes of the exact natural standard.

36. Now the mortality of men of the soldier's age in the healthy parts of England and Wales is such that, on an average, 8 die annually in 1000 living.

37. Recruits for India undergo careful examination; and when soldiers are attacked with consumption, or any disease that is not soon fatal, they are invalided. Thus their recorded mortality in peace, under such conditions as can be commanded for the army at home, should not exceed that experienced in the healthy districts of England, which, as regards their salubrity, are by no means perfect models.

38. Half the population of England and Wales is concentrated in town and city parishes, under many unfavourable conditions; and the annual mortality of Englishmen of the soldier's age is 9 in 1000.

39. The mortality of men of the same age in the unhealthiest towns of England, and in the unhealthiest trades, is at the rate of 12 per 1000.

40. Thus the mortality varies in different cases; and as it rises from 8 to 9 and 12, unfavourable sanitary conditions are discovered accounting for every degree of increase. The same principle holds in the mortality of the British army at home, which was at the rate of 17 per 1000 annually, and is now declining in proportion as the causes of disease are abolished or mitigated.

41. The mortality of non-commissioned officers and men serving in the British army abroad in the four years 1857-60 was at the rate of 41 per 1000; of the officers, the mortality was 30 in 1000.

42. The annual mortality of officers serving at home and abroad was 17, of non-commissioned officers and men 33 in 1000, during the years 1839-53 of European peace. Sir Alex.

Tulloch gave, in his evidence, a series of War-office returns of the strength, deaths, and mortality of the Royal army in India during thirty-nine years, 1817-55; from which it appears that the mean strength in the three Presidencies was 20,332, and the registered deaths 55,584: so the annual rate of mortality was 70 per 1000. The Mahratta, Pindaree, Burmese, Affghan, Sindh, Sutlej, Punjab, and Chinese campaigns account, according to his estimate, for 10 out of the 70 deaths.

43. The difficulties of obtaining results at once exact and precise were enormous; and the medical returns for some time appear to have included only the deaths in hospitals. The Commission therefore selected for analysis the Nominal Rolls of strength and casualties at the India House relating to the late Company's European troops.

44. The collection of annual Casualty Rolls at the India House was "compiled upon the principle of accounting for every man becoming ineffective in the year." Verified by the signatures of commanding officers and adjutants of corps, the rolls are perfectly intelligible and substantially correct; they have therefore been analysed elaborately for the purposes of this inquiry.

45. The European troops of the Company, unlike the Royal army, served in India only, where they remained until death, or until they returned home. The deaths in the fifty-seven years, 1800-56, amongst all the Company's non-commissioned officers and men, including invalids in India, amounted to 40,420, out of an aggregate of 588,820 years of life, obtained by adding up the average annual strength in those years; so, the annual rate of mortality has been 69 in 1000 during the present century, up to 1856.

46. The rate of mortality was as high as 134 in 1804 in the first Mahratta war, and it was as low as 41 in 1852. It was high, again, in the years of the mutiny, and it has been subsequently lower than the Indian standard. From the rate 55 in 1770-99, the rate rose to 85 in the 30 years 1800-29; and the mortality fell to 58 in the 27 years 1830-56; so that the death-rate of the British soldier since the first occupation of the country down to 1856 has oscillated round 69 per 1000.

47. If the mortality is set down at 69 in 1000, it follows that, besides deaths by natural causes, 61, or, taking the

English standard, 60 per 1000 of our troops perished in India annually. It is at that expense that we held dominion there for a century; a company out of every regiment was sacrificed every twenty months. These companies faded away in the prime of life, leaving but few children; and they were replaced at a great cost by successive shiploads of recruits.

48. The last accessible returns, and the experience of the mutiny, were in strict conformity with the statements of the Commission. With a strength of 30,662 British soldiers, who sufficed for all purposes, England lost for years 2134, or 69 per 1000 men annually by death; but, from the returns of 1861, it appeared that there were then in India 75,759 men, including non-commissioned officers, besides 8324 commissioned officers. The proposed European establishment was to comprise 73,000 men, or a third part of the British army, of whom, at the rate of 69 per 1000, the loss by death would be 5037 annually. This was the prospect had matters remained as they were up to 1856.

49. The sick in hospital by one estimate would be 7300; by another, 6132. This was an alarming prospect to the country, and distressing, inasmuch as the deaths out of the same number of men at the soldier's age is only 657, or at the rate of 9 per 1000. Instead of losing 657 lives annually, there was a well-grounded fear that, should years of war, and cholera, and fever, and dysentery, and liver disease recur as they had in past times, England might be called upon to supply the places of 5037 dead soldiers by 5037 recruits. This it was felt would, in addition to other casualties, be an undue strain upon the military resources of the country.

Invaliding.

1. In addition to the heavy losses by death during the mutiny, there was great loss by invaliding of 81, 74, and 60 per 1000 in the three years of 1860-62 following upon it.

2. The soldiers who were invalided from the Royal army and from the Company's force included many who laboured under slow fatal diseases, such as chronic dysentery, and other diseases which were contracted in the service. The Commission did not bring them into account. Yet the returns showed

that, while the annual deaths during fifty-seven years was at the average rate of 69 in 1000, the other casualties were 82 in 1000; making a total of "casualties" from all causes, including invaliding and discharges, of 151 in 1000. The Commissioners only brought 69 per 1000 into prominent account.

3. The change from long periods of service to the short limit of ten years in the general army has tended, of late years, to reduce the apparent rate of mortality in India, inasmuch as unhealthy men are got rid of when their term of service expires, and only the healthy, well-behaved, seasoned soldier remains, if he chooses to volunteer for a further term.

4. Sir Alexander Tulloch, who estimated the annual mortality of the Royal army at 70 deaths in 1000, referred 10 to casualties in the field; and the Commission was of opinion that more than 10 out of the 82 men discharged for other casualties, including chronic maladies, would die of diseases induced by India.

P.S.—I may here observe, in reference to medical statistics generally, but especially to allegations occasionally made as to exaggerations in reckoning mortality in armies, that my friend, the late Major-General Sir Alexander Tulloch, K.C.B., often stated to me, as the result of his unequalled experiences in the preparation of his great work on the medical statistics of the British army over thirty years, and comprising a review of the health-history of more than a hundred thousand men, that any investigation such as that conducted by the Royal Commission of 1857, by whomsoever carried out, must necessarily eventuate in an under-statement of mortality; inasmuch as a certain number of deaths occur annually in an army—especially when scattered abroad in the manner of the military forces of this country—which cannot be traced. More or less of this kind of inaccuracy—the very reverse of exaggeration—must, indeed, attach to all such examinations and reports.

Inefficiency of the Army in India from Sickness.

1. OF 1000 of the East India Company's forces in London, 16 were constantly sick on an average, at the ages of twenty to thirty; and in the Friendly Societies of England the amount of disability among artisans is nearly the same at the same

ages. At the next decenniad the proportion of constantly sick becomes 17 or 20 in 1000.

2. It was calculated by Sir James Annesley, in his work on the Diseases of India, that 100 sick out of the same number was then a normal state in India. This important element, as already stated, has not hitherto been sufficiently attended to in the army statistics; and as the Royal Commission had not the new returns recently introduced, it was impossible to show how much of the inefficiency was caused by each disease.

3. Several diseases, such as rheumatism, ophthalmia, syphilis, which are rarely fatal, cause a great deal of inefficiency, of which the admissions into hospital furnish a very inadequate measure. On the other hand, some fatal diseases, such as cholera and consumption, produce very different results on the returns of sickness; for a fatal case of consumption lasts two years; of cholera, two days.

4. A table drawn up by the Commission shows that, on an average in the stations of Bengal, 84 men in a battalion of 1000 men had been constantly in hospital. This was not illustrated by a diagram, but it is easy to conceive the facts:

5. A thousand men were at a station; 84 of their number were sick in hospital, where 69 died annually.

6. With this amount of sickness, an army of 70,000 British soldiers in India would, at the old rate, have had a vast hospital of 5880 beds constantly full of sick, and losses yearly of 4830 men by death, or nearly five regiments.

7. On September 3rd, 1858, the total European force in India was 81,971; but only 50,975 were fit for duty, 6616 being sick in hospital, 11,555 on the passage out, and 12,821 in the depôts at home. To 57,595 in India, including the sick, 24,376 were away; to 100 present 42 were absent.

8. The number absent at this period was unusually great, and, instead of adding 42, the Commission added 20 per cent. to the numbers serving in India. The legitimate purposes of the depôt are recruiting and training, in order to maintain the efficiency of regiments in India.

Pecuniary Cost of Sickness in the Army in India.

It may be assumed, as the sick soldier is a serious encumbrance in war, that the 5880 sick cost the country as much as

5880 effectives. If there were no sick, the army might be reduced to that extent.

2. It has been shown that the army expenditure is equivalent to £100 per man, so the cost of the sick at these rates is £588,000 annually. Deduct £200,000 for sickness assumed to be inevitable, and £388,000 remains.

Sickness and Life-Loss in War in India.

1. The mortality of the army has always hitherto been raised by war. This is evident upon inspection either of the mortality amongst the Company's troops or the Queen's. The Company's European troops died at the rate of 85, 134, and 101 per 1000 in 1803-4-5; the period of the Mahratta War.

2. In the wars of the Marquis of Hastings, the mortality of the troops rose to 90 and 117 per 1000; in six of the years, 1813-21, the annual mortality exceeded 90 per 1000.

3. In the Burmese War of Lord Amherst, the mortality of Europeans was at the rate of 113, 106, and 130 in the three years 1824-6.

4. Since that time the Company's forces have been healthier in war; in the Affghan and Sikh campaigns their mortality did not exceed 70, 80, or 84 per 1000.

5. The whole army is rarely engaged; consequently the effects of a war are partial and fall upon particular regiments. Thus, in the year 1845, the mortality of the Queen's troops was at the rate of 199 per 1000 in Bengal; but did not exceed 46 in Madras and 71 in Bombay.

6. The Queen's troops in 1840-48, out of a force varying from 8000 to 12,000 in Bengal, lost numbers ranging from 781 to 2213 annually; and the mortality frequently exceeded 10 per cent.

7. It is impossible to read the losses of particular regiments in the war of the Mutiny, without being struck with the inextinguishable valour of the British soldier: but it was disease, and not the enemy, that killed them; for out of 9467 men dying amongst regiments in India prior to the mutiny, or sent out in 1857-8, only 586 were killed in action or died of wounds.

8. All the evidence goes to show that the mortality in the wars of India is chiefly from the diseases before referred to,

and that the diminution in the mortality of wars before the mutiny was due to improvements in the sanitary arrangements. The battles in Sindh and the Punjab were as fiercely contested as any in which British troops have ever engaged native forces.

Cost of the British Soldier in India.

1. The value of a man who, with his arms, costs the country £100 a year, reckoned only at a few years' purchase, is considerable, and the loss either of his life, of his health, or of his efficiency, is not to be lightly regarded, especially as it occurs most frequently and inopportunately in the field, when his services are most required.

2. The finance accounts of the army in India were defective and often delusive; but the various reports, and particularly the papers of Colonel Baker and Sir Alex. Tulloch, on the relative expenses of the late Company's European troops, throw much light on the subject, which has also been discussed with impartiality and judgment by Mr. Hammick. The Commissioners appended a table, compiled from his, giving the chief results; for the sanitary state of the army is intimately linked with the finances of India, and influences them to a large extent.

3. The military expenses of India for the year 1856-57 amounted to £13,322,859, including the home charges for recruits, transports, and ineffectives. Deducting £166,386 for the local civil corps, £13,156,473 remains.

4. The European officers and men in India in 1856 were 45,104, to which should be added, perhaps, 9021 in depôts at home or on their passage, making 54,125 in the pay of the Indian Government.

5. The financial accounts did not enable the Commission to determine directly the cost of the European force, as the expenditure was mixed up with that of the native army; but an approximate estimate was framed.

6. The native non-commissioned officers and men in the year were 235,221, and the ratio of the cost of the Europeans to that of the natives was set down as 289 to 100, or nearly as 3 to 1; consequently the cost of 235,221 native was equivalent to the cost of 81,349 European soldiers.

7. This number, added to 54,125 Europeans, makes the cost of the Indian army equivalent to the cost of 135,474 Europeans. But the total military expenses, £13,156,473, divided by 135,474, gives £97 per man as the annual cost of the European force; or, taking only the Europeans serving in India (45,104), the whole force is reduced to 126,453, and the cost per man was £104.

8. For our present purpose it may be assumed that £100 a year on an average is expended on the European soldier serving in India, this cost including the cost of arms, recruiting, and retired allowances for officers and men.

9. The frequent errors in estimating the cost of troops in India has arisen from the omission of important items. Indeed, Col. Baker omits in his table staff charges in India, and the cost of camp equipage, ammunition, stores, arms, bedding, punkahs, hospital attendants, medicines, and transport in India, which raise the cost of a regiment 1000 strong to £100,000.

10. The charge for barracks and buildings is £13 3s. per man, so that the accommodation for ten men costs £131 a year. This is a high rent; yet Col. Baker says he had, in his late office of Secretary to the Government of India, peculiar opportunities of knowing the cost of permanent barracks for European regiments on the enlarged scale lately introduced, and is satisfied that the annual amount will not be less than £15,000 a regiment.

11. Sir Alex. Tulloch, on the other hand, quotes a return to show that the building of a barrack for a whole regiment ten or twenty years ago cost only £22,213; which implies, he says, an annual expenditure of £2200.

Mortality among Officers of the Indian Army, the Civil Servants, Retired Officers, and Pensioners.

1. It will be observed that while, during a long series of years, the mortality of the British soldier in India was at the rate of 69, the mortality of the officer during twenty years was at the rate of 38, in 1000.

2. During the twenty years 1814-33, for which the mortality of officers was 38, the mortality of non-commissioned officers

and men was 83, in 1000. By taking the rate at 69 the case is understated.

3. It appears to be a fair deduction from the comparison here made, that the 31 annual deaths in excess of 38 were due to other causes than the climate of India; to which officers as well as men were everywhere exposed. We may proceed a step further in this direction; for the civil servants living in the unhealthy and healthy districts alike died at the rate of 20 in 1000.

4. The mortality of the Bengal military officers of the Company was at the rate of 31, of Bombay 39, and of Madras 45, in 1000.

5. Of the officers of the Royal army in India, the mortality was 34 in Bengal, 33 in Bombay, and 36 in Madras.

6. The local disadvantages in Bengal were, in those days, in some way compensated; and the returns of the military funds of the three Presidencies confirm this result.

7. To illustrate the extent to which the insalubrity of India affected civilians, officers, and soldiers serving there, we take four armies, each consisting of 33,615 young men of the age of nineteen :—

a. The first army, remaining in England, experiences the ordinary rate of mortality, and loses 254 in the first year, 276 in the second, 281 in the third, and so on; it is reduced to 30,453 men, of the age of thirty, in eleven years.

b. The second army loses also 254 men in the first year; and it then lands in India, where it loses 353, 412, 452 men, as it suffers from the diseases and dies at the rate of Madras civilians; it is reduced to 28,916 men in eleven years.

c. The third army of the same strength loses 254 in the first year, or at the age of nineteen to twenty; it then lands in India, and experiences the same rates of mortality as the military officers, and loses 865, 840, 819, and so on in successive years, until it is reduced to 24,610 in eleven years.

d. The fourth army loses 254 in the first year; it then lands in India, and, suffering from the diseases of the Company's soldiers, it loses 2052 in the first year of its residence in India, 1811 in the second; and so it is rapidly reduced by death to 19,617 in eleven years.

8. If there was much to shock the mind in these contrasts,

they did not lack elements of consolation; for the unnatural death of the British soldier was apparently not the inevitable result of the climate of India, to which officers and civilians were also exposed.

9. The Company had, on an average during the twenty years 1814-33, serving in India 4219 military officers, among whom 3194 deaths occurred; consequently the annual mortality was at the rate of 38 in 1000. Several of these officers were in civil employ, and some were on leave of absence; but they were all exposed to the Indian influences.

10. This was not the case with the 1079 officers of the Royal army, a considerable portion of whom were apparently at the depôts in England; so the deaths were 742, and the annual mortality was at the rate of 34 in 1000.

11. The annual loss of the 5298 officers of both armies was 197. Now, of men of their ages in England, about 53 die annually; consequently, 144 officers died every year in India in excess of the natural deaths.

* 12. In the twenty years the deaths at the English rate would have amounted to 1060; and, as 3936 officers died, the excess by violent and unnatural causes was 2876.

13. Of this number, 122 were killed on the field or died of wounds; consequently, while the danger to which they were exposed on the field of battle was fatal to 122 officers, the dangers from disease were fatal to more than twenty times that number.

14. The value of the lives of officers, and the irreparable consequences of their loss to their families, pointed out at an early period the necessity of extraordinary measures for the promotion of life insurance, and led to the establishment of the various funds under Government encouragement.

15. One of the disadvantages to the officer arising from the insalubrity of India is shown by the high premium which he has to pay for the insurance of his life. Thus, at the age of thirty, the annual premium of the insurance office on a life in England is £2 4s. 10d.; on an officer's life in India it is £4 to insure £100.

16. The soldier's life is still more precarious, and, allowing 10 per cent. for expenses, by his life table he would have to pay £5 15s. 3d. to insure the same sum at his death. To the

same extent as the shortening of life increases the risk of insurance, it diminishes the accumulation of capital.

17. The rate of mortality in the whole civil service of Bengal was, according to the returns of Mr. H. T. Prinsep, at the rate of 21.0 at the age of 20-25; 20.1 at 25-35; 28.7 at 35-45, and 41.1 at 45-55.

18. In the Bombay Civil Service the mortality ranged from 24 to 26 under the age of fifty.

19. The experience of the Madras Civil Fund from 1760 to 1853 exhibits a still more favourable result. The mortality ranged, at the ages of twenty to forty-five, from 14 to 18 per 1000; and at these ages the authenticity of the table is unshaken by criticism.

20. Mr. Neison's report on the Madras Civil Fund of the 20th of July, 1855, is here referred to. The expectation of life is not higher, by this table, at the age of fifty-five, than it is by the table for healthy English districts; but the discrepancy of its results with Mr. Neison's earlier table is by no means fatal to its authority.

21. The civil servant and the military officer, at the close of their career, habitually return to England, where they encounter the cold vicissitudes of a climate in which they were born, but to which they have long been unaccustomed.

22. "The 'old Indians' are divided into two classes. The veterans, who, like Hastings and the Wellesleys, bring home their native vigour, tempered in the Indian fire; and those who are either shattered by fevers, dysentery, liver diseases, and apoplexies, or are actually suffering from their sequels. Sir Ranald Martin has described their condition, and has shown how it can be ameliorated."*

23. The retired civilians probably enjoy the same advantages over the military in England as they enjoy in India; for many of their eminent members, after having served for a certain time in India, attain advanced ages.

24. Only one Governor-General (Cornwallis) died at his post in India during ninety years; and though the career of the last two terminated prematurely, the fourteen eminent men who have held that high office since 1772, for periods varying

* Diseases of Tropical Climates, by Sir Ranald Martin.

from one to ten years,—or six years on an average,—filled their expected number of years by the English life-table.

25. The pensioners in England who have served in the East and West Indies die much more rapidly than the officers; but this is probably due to the circumstances in which they are placed. And it is not an easy matter to throw off at home the habit of dram-drinking which they have been taught in the tropics.

26. In the present section the facts lead to the following results:—

a. The mortality of the officers who were stationed with the British and native troops, regular and irregular, all over India was excessive, and involved great losses of life and property; but it was less by 31 per 1000 than the mortality of the soldiers. It follows that the lives of nearly half the soldiers, in less unfavourable conditions, might for the future be saved.

b. The civil servants, at the soldier's age, did not die at a rate higher than 20 in 1000; and as they were distributed all over the country, it follows that the climate of India is not necessarily fatal to any higher proportion. The excess is due to other causes.

c. The diseases of the Indian civil servants, from which they have a comparative immunity in England, are known to be the same as are fatal to the soldier.

Mortality among the European Population; Officers' Wives and Children; Eurasians.

1. The British population in India, according to the returns of the several Governments, amounted to 125,945; consisting of an army, its wives and children, and people in civil life, including the civilians in the public service.

2. At the census of 1861, the European officers and men of the army in India were 84,083, the civilians were 22,556, and the women were 19,306.

3. Allowing for any defects in the returns, it is evident that, exclusive of the army, the population would not fill one English county town; and, including the army, it would be less than the population of the London parish of Marylebone.

4. Of the Royal army, the proportions married, it will be

seen, vary at each age: 93 per cent. of all ages were unmarried men; of the Europeans of the late Company's regiments, 70 per cent. were unmarried; of the civil population, of the age of twenty and upwards, 50 per cent. were unmarried—a large proportion as compared with the unmarried population of England.

5. A higher proportion of the officers than of the men in the Royal army was married.

6. The rate of mortality among married soldiers and the unmarried has never been ascertained in either service; but Mr. Griffith Davies ascertained that the married officers in the Bengal Military Fund died at the rate of 27 in 1000; the unmarried at the rate of 38 in 1000.

7. The subject requires further investigation; for this excess of 11 deaths annually is the more remarkable as the unmarried officers were younger than the married.

8. The married ensigns died at the rate of 16, the unmarried at the rate of 36 in 1000 annually. Here the life without a home in India is triply fatal.

9. The women and girls enumerated as "British-born subjects in India" amounted to 19,306, of whom 9773 were twenty years of age and upwards, including 7570 wives, 1146 widows, and 1001 unmarried women. 786 wives under the age of twenty make the number of wives of English origin, under the age of forty-five, to be 7626, scattered all over India.

10. The wives of several Indian officers, if invalids, go to England; but the number in India in the early periods is so great that the mortality of the wives of officers of the Indian army may be taken to represent the mortality of English women in India.

11. At the ages from twenty to forty the mortality of wives and widows in the Madras Military Fund did not, according to Mr. Samuel Brown, exceed 14 in 1000 per annum.

12. They were exposed to many of the same insanitary influences as were the soldier and the officer; but the mortality is not higher than it was in London during the last century.

13. All the deaths over 10 in this class, as in the others which have been investigated, are by the diseases not only of India, but of all unhealthy places. They may be reduced by energy and action, as they were increased by inaction.

14. The wife and children of the non-commissioned officer

and soldier do not fare so well as those belonging to the superior ranks, provision for their accommodation being inadequate. The women are exposed to great hardship, and die at the rate of 35 per 1000, including those of English birth and the Eurasians.

15. In the Lower Orphan School of Calcutta the mortality was double or treble the English rates; but results greatly more favourable are obtained at the Laurince Military Asylum on the hills.

16. Eurasians exceeded the British in the city of Calcutta at the census of 1837; for while the British amounted to 3138, the Eurasians were 4746, or, including those of the suburbs, 5981.

17. Mr. Tait and others have investigated the mortality from imperfect data; and we see no reason to justify the inference that the mixed race of Anglo-Indians is an exception to the rule, that the mortality of all the races in India bears a constant proportion to the variable sanitary conditions in which they live.

Nature of Fatal Diseases in India, and of Attacks of Sickness.

1. The results of all investigation in India show clearly how much of the sickness and mortality is due to a few acute diseases, which are rendered fatal by well-known causes.

2. Quoting a statement submitted by the author of this history, the Commission reports that the great endemic diseases of India—those which injure the constitution or destroy the life of the British soldier—are fevers, dysenteries, diseases of the liver, and epidemic cholera, which has for many years engrafted itself on the endemics of the country. Compared with these all other diseases are of minor extent and importance.

3. Of the various obstacles which bar the colonisation of the white man in tropical regions, and of the many causes which reduce the strength of our armies there, remittent fever, he says, is the principal.

4. Remittent fevers are found almost everywhere throughout the East Indies, varying in their intensity and in their complications according as they occur in deltas, along marshy banks or at the embouchures of rivers, in plains extending from the bases of mountain ranges, termed “tarāces” in par-

tially inundated or irrigated lands, or in tracts traversed by percolating streams or occupied by jungles, or in certain low hilly countries.

5. The seaboard, especially where there is jungle or salt marsh, and the adjacent islands when of a jungly or marshy nature, are peculiarly pestilential; and so are often drying-up marshes and the drying-up beds of rivers.

6. The four diseases mentioned are almost exclusively diseases of the sultry plains of India, and when any of them are found in the elevated lands, they are generally modified in degree and reduced in proportionate frequency—certain forms of bowel complaint, when the sufferers are removed from the plains to the high grounds, being the only exceptions.

7. Even in regard to cholera, the most acute of all diseases, while the proportionate mortality of those attacked is everywhere the same, the proportionate numbers seized in high and in low situations differ most widely. Cholera, as well as the endemic diseases of the plains, are, in general, of rare occurrence in the elevated ranges of India, where the air and water are comparatively pure.

8. On the plains of Bengal proper, out of a British force of 25,431 men serving for eight and ten years respectively in Calcutta, Chinsurah, and Berhampore, there occurred 13,596 cases of fever; while in the healthier upper provinces of the same Presidency, with diseases generally of a less degree of severity, out of an average British force of 23,731 men serving there during seven years, there occurred 14,159 cases of fever; and throughout India generally 50 per cent. of all the admissions into hospitals were from fevers.

9. Lower Bengal has at all times been unfavourable to European health; and out of the above force of 25,431 men serving there, there occurred 8499 cases of dysentery and diarrhoea.

10. Out of an aggregate British force of 211,993 men serving in the Presidency of Bengal from 1812 to 1832, there were admitted into hospitals on account of diseases of the liver 14,015 cases, with 924 deaths; while out of an aggregate force of 331,775 men similarly placed, from 1833 to 1854, there were 18,765 admissions and 1345 deaths from liver diseases.*

* Evidence of Sir J. R. M.

11. Comparing the deaths of British soldiers for periods of sixteen years (1830-45) in Bengal and for seven years (1848-54) at home, the annual rate of mortality was 10 per 1000 in England, and 67 per 1000 in Bengal, of which 58 per 1000 were by zymotic diseases.

12. The fevers—ague, remittent and continued—killed 17 men in 1000 in Bengal; dysentery and liver diseases, 20; cholera and diarrhœa, 18.

13. One thousand British soldiers at home experience about a thousand attacks of sickness in the year; but in India the soldier's sickness was doubled. To one illness of the labourer, the soldier was liable to four of at least equal severity.

14. Thus, from a return supplied by Dr. Balfour, it appears that the 16,850 troops serving in Bengal furnished the hospitals with 172,388 cases in the five years 1850-54, when 4461 cases terminated fatally.

15. A battalion of 1000 men sent yearly, on an average, 2045 cases to the hospitals; each soldier in India was exposed, therefore, to two attacks of illness in the year instead of one.

16. The returns furnished by Sir Alex. Tulloch showed that in the troops of the line the attacks of sickness ranged at the different stations from 988 to 3225 per 1000 men.

17. The attacks of sickness were sometimes slight; but in a large number of cases they were severe, painful, and fatal.

18. Even from the facts and circumstances here briefly stated it must be evident that, over a wide extent of years, there occurred throughout India an enormous amount of unnecessary and preventable disease, suffering, and death, to the great loss and reproach of the country.

19. It is the neglect of every-day dangers that has cost us so many lives there, and this fact ought continually to be present to the recollection of the authorities, civil and military. In actual warfare the soldier is compelled to disregard many exceptional dangers from climate, but he is never justified in omitting to provide against constant and uniform danger. Until this principle is carried out in sanitary matters, the sickness in our army in India must continue to be a burden and a discredit to us.

Lives wasted in India in each Year of Service.

1. The mean term of service in India, immediately deduced

from a table, was 8·6 years, and 11 recruits were required annually to every 100 men. To maintain an army of 85,856 men, 10,000 annual recruits would be required, even if the term of service were as prolonged as it was under the late Company's regulations. The recruits entering were reduced to less than half their original number in eight years; their probable term of service was, therefore, between seven and eight years.

2. A return handed to the Commission by General Russell threw some light on the reductions. Out of 1064 non-commissioned officers and men of his regiment (the 84th), who landed at Moulmein in 1842, only 93 landed in England on its return in 1859; thus, the numbers were reduced from 1064 to 93 in seventeen years, and the regiment was almost completely renewed in India. It was joined by 1248 recruits, and the deaths were 817.

3. Now, had the mortality been uniformly 5 per cent. per annum (and the witness said it had been 3 per cent. for fourteen years prior to 1857), the original numbers would only have been reduced in this case by death to 455. There are, besides death, many casualties which reduce corps serving in India, and they require to be carefully adverted to.

4. In tables furnished by the Commission it was shown that 100,000 men were reduced to 9604 in twenty years of service by 90,369 casualties of every kind.

5. In the course of service there occurred 40,447 by deaths, 14,627 by invalidings, 3558 by purchasing their discharge, 8972 by the expiration of their terms of service, 968 by promotion, 5724 by transfers to the Town Major's list, 13,976 by transfer to other corps, 1818 by desertion, and 306 by other causes.

6. Half of the deaths (21,499) took place in the first five years of service, and the numbers invalided increased slightly in each quinquennial period.

7. The decrement, year by year, of the British force serving in India was shown in another table, in which it was seen that 1000 effectives had been reduced to 96 in twenty years. Now, the 1064 men of the 84th were reduced to 93 in seventeen years; and this, while it agrees very closely with the tabular results, points to the fact that the Queen's regiments

were reduced more rapidly than the Company's by the shorter terms for which the men enlisted.

8. The half of a regular army so constituted consists of men who have served less than six years, and not more than a fourth of the men are veterans of ten years' standing, on whom the discipline and solidity of an army greatly depend.

9. It is evident that the recruiting is more difficult, and that the losses from other causes than death are greater, in an unhealthy than in a healthy army ; for the invaliding, the desertion, and the discharges from all are influenced by sickness.

10. The Commission constructed two tables, the one showing how the same number of recruits (100,000) would be reduced year after year by death alone, and the other showing the reductions by death and invaliding together.

11. By death 1000 would be reduced in twenty years to 344 ; by death and invaliding to 216 ; by death, invaliding, and other causes, as we have seen, to 96.

*Influence of Term of Residence in India on the Rates
of Mortality.*

1. This subject involves the important question of acclimation. The Report of the Commission presents a table in which the facts are arranged with reference to the soldier's years of service, and it is evident that the mortality (65·2) during the first year of service was higher than it was subsequently.

2. It decreased gradually, and, became sensibly less in the fifth year, 44·1 ; it then rose slowly to 47·0 at the second quinquenniad (5—10) ; 52·8 at the third.

3. The reduced number, 43·0, at the fourth period of residence (15—20 years) arose probably from the elimination of the sickly by invaliding, which then became active (6 per 100).

4. This, however, although it took away a fourth of the numbers annually, did not prevent the mortality, partly from advancing age, rising to 62·5 per 1000 in the last period of service.

5. It is evident that when men are exposed to the operation of very unhealthy places many of the weak are cut off at once ;

while of the survivors some are exceptionally less capable of resisting the local poison, and others are so enfeebled by its influence that they rapidly succumb.

6. These two sets of causes in conflict were nearly in equilibrium in India, so that the mortality always remained high; and if acclimation in the ordinary sense took place, it was at advanced ages.

7. The causes which during a hundred years destroyed British soldiers in India, like arsenic or any other poison, did their fatal work in every year of age and of residence; and, indeed, the zymotic agents which produced cholera, dysentery, liver disease, and fever in all its forms, comport themselves like organic poisons.

8. This view is confirmed by a new combination, in which a table shows the mortality in different years of service amongst those entering India early and late in life; but, upon the whole, early entry into India appears to be an advantage, not only at first, but in after-life.

9. It is further evident, from a comparison of the mortality in the several corps and presidencies, that the mortality in India depends on the intensity of the zymotic poisons, and the time at which the men are exposed to their influence, rather than on the incident that they have resided one, two, ten, or more years in the climate of the tropics.

Acclimation.

1. Sir Ranald Martin states, that all statistical observations go to disprove anything like acclimation in the East Indies. On the contrary, he says, disease and death increase with length of service and age.

2. The opposite opinion seems to have arisen from the circumstances that some men have learned by experience the art of managing themselves, and so of preserving their health in unhealthy districts, and partly from confounding the effect of heat and moisture (i.e. climate) with that of local sanitary condition. There *is* acclimation to heat; there is none to "endemic miasmata."

3. We have already shown, statistically, the influence of length of residence in India on the rates of mortality amongst

soldiers ; but there has been considerable difference of opinion as to the effect of acclimation on the health and efficiency of troops.

4. It has been stated, on the one hand, that men get accustomed to the climate by length of residence ; and hence, that there is hardly a period, so far as health is concerned, to which their term of service should be limited.

5. Others, again, have arrived at an opposite opinion, and one much more in accordance with observed fact. Dr. John McLennan, when asked whether a man of one year's service, or of ten years' service, would be the more able to endure exposure and fatigue, answers, "The fresh man decidedly."

6. Colonel Greathed says :—"I believe that the medical officers will say that the longer a man remains in India the worse he gets ; and I believe there can be no doubt of it. I do not believe in acclimatising."

7. "For the first five or six years a soldier is a very good man indeed in India ; but after that he begins to break down, and he is not so good a man as he was."

8. The whole nature of the evidence in the statistical reports is against the doctrine of acclimation, as generally understood, and in favour of limiting the period of service in India to about ten years. It does not, however, necessarily follow that this limit need be maintained, if the sanitary condition of the troops be improved, as it may be.

Recapitulation.

THE inquiries of the Royal Commission have shown—

1. That by far the larger proportion of the mortality and inefficiency of the Indian army had arisen from endemic diseases, and notably from fevers, diarrhoea, dysentery, cholera, and diseases of the liver.

2. That the predisposition to these diseases was in part attributable to malaria, in conjunction with extremes of temperature, moisture, and variability.

3. But that there were other causes of a very active kind in India, connected with stations, barracks, hospitals, and the

habits of the men, of the same nature as those which are known in colder climates to occasion attacks of those very diseases from which the Indian army suffered so severely.

Bad selection of stations.—In examining into these causes, we find that the stations generally had been selected without reference to health, and mainly from accidental circumstances, or for political and military purposes, real or supposed. Many of them were situated in low, damp, unhealthy positions, deficient in means of drainage, or on river banks, close to unwholesome native cities or towns.

Bad sanitary state of native towns and bazaars.—The towns and bazaars in the vicinity of lines were in the worst possible sanitary state—undrained, unpaved, badly cleansed, often teeming with offensive and dangerous nuisances,—with tanks, pools, and badly-made surface gutters, containing filth and foul water; the area overcrowded with houses, put up without order or regularity; the external ventilation obstructed, and the houses overcrowded with people; no public latrines, and every spare plot of ground covered with filth in consequence; no water-supply, except what was obtained from bad shallow wells and unwholesome or doubtful tanks. These towns and bazaars were the earliest seats of epidemics, especially of cholera, before their ravages extended to the European troops in the vicinity.

Sanitary defects of stations.—None of the stations had any subsoil drainage; and there were no other means of removing the rainfall, except surface gutters. The ground about the lines was often broken up in pits and hollows, filled with stagnant waters; or it was traversed by unwholesome ravines or nullahs. In certain states of the weather and wind, nuisance was experienced in the lines from these causes, and from the foul state of neighbouring native dwellings. Many of the older stations were irregularly built; and the buildings were arranged so as to interfere with each other's ventilation.

Defects in construction of barracks and hospitals.—Both barracks and hospitals were built at or close to the level of the ground, without any thorough draught between the floors and the ground; and the men, both in barrack rooms and sick wards, were exposed to damp and malaria from this cause, as well as from want of drainage. The ventilation was generally

imperfect; and, from the arrangement of the doors and windows, men were exposed to hurtful draughts.

Overcrowding.—Many of the rooms were too high, and, as a consequence, there was much surface overcrowding, both in barracks and hospitals, although with large cubic space. In a number of instances both the space and the area per bed were much too small.

Want of light.—Barracks and hospitals had frequently no glazed windows, and only wooden shutters. Both barrack rooms and sick wards were, as a rule, dark.

Bad position of beds.—There were often four, or even six, rows of beds between the opposite doors or windows, increasing greatly the already existing difficulty of ventilation, and exposing the inmates to foul air.

Barrack rooms held too many men.—The greater proportion of the force was lodged in barracks in such large numbers per room as to be very injurious to health; many of these rooms having been several hundreds of feet in length, and some of them containing from a quarter to half a regiment each!

Defect of water-supply.—Water-sources had been, with one or two exceptions, selected without analysis, although it is always hazardous to omit this precaution. The supply was taken from shallow wells and tanks, both of which were very liable to pollution. In a few cases the water was derived from rivers: it was drawn by dipping, and carried in skins, thereby increasing its impurity.

No precautions were taken for purifying drinking-water, and the whole arrangement resulted in a supply of water, for drinking and culinary purposes, of a bad or doubtful quality, and such as would be rejected in any improved sanitary district in this country. This unsatisfactory condition of the water-supply was one of the cardinal defects at stations in India.

Deficient means of cleanliness.—Ablution and bath accommodation was often very deficient, and sometimes there was none. Very often there were no baths, and where baths existed there were not enough.

Cooking.—Means of cooking were primitive and imperfect, hardly suitable for permanent barracks, although the cooking was considered sufficiently varied.

Latrines and urinals.—Privies and urinals were generally of

a bad or defective construction. The contents were removed by hand, often producing great nuisance. No drainage for either privies, ablution-rooms, or cook-houses: the foul water was received into cesspits, or carried away by hand.

Hospital defects.—Hospitals were constructed on the same general plan as barracks. They had no proper ablution or bath accommodation; no waterclosets, only open privies, situated at a distance; no drainage, no water-supply, except what was drawn and carried by hand-labour. The bedsteads were often of wood, instead of iron; and mattresses and pillows of various materials, instead of hair, as they ought to be. No trained attendants were provided for the sick.

Ration.—The soldier in India had a complete ration, of good quality; but the ration was not varied to provide against the effects of the soldier's sedentary habits; and no difference was made for the cold and hot season. For the hot season the ration contained too much animal food and too little vegetable. Mutton was not issued often enough; and fish, along the coasts and rivers, was not sufficiently estimated and considered as an article of the soldier's diet.

Clothing.—Flannel under-clothing, and a change of this dress after a march, would be very advantageous; and a better system of supplying boots was much required.

Drink: intemperance.—The use of spirituous liquors was highly detrimental to the soldier's health in India, and was one of the chief personal habits which injured him physically and morally. Abstinence from spirits has always been attended by greatly improved health, even under circumstances otherwise unfavourable, and by diminution of crime. The only advantage of the issue of spirits in canteens was stated to be, that it prevented the soldier from obtaining more unwholesome spirits in the bazaar. The moderate use of malt liquor or light wines is much less injurious to health than that of spirits.

Syphilis.—Connected with habits of intemperance and want of occupation was the prevalence of syphilis, a disease which occasioned a very large amount of inefficiency and invaliding.

Deficient means of instruction and recreation.—Means of recreation were few, of exercise none, of instruction limited.

The soldier's habits were sedentary where they ought to have been active. He was thus led into vice and intemperance.

He had no means of occupying his time profitably. He complained of the weary sameness and *ennui* of his life. This, together with his diet and allowance of spirit and malt liquor, was bad for his health—physical as well as moral health.

Results of removable causes of disease.—Making every allowance for the influence of climate, which, however, is altogether secondary, except as increasing the effect of removable causes of disease, the whole tenor of the evidence proved that the bad sanitary arrangements enumerated, together with unfavourable habits as to diet, intemperance, and want of occupation, on the part of the men, were causes sufficient to account for a large portion of the sickness, mortality, and invaliding occasioned by those diseases from which the army in India mainly suffered.

State of sanitary administration.—The arrangements for the prevention of disease were either non-existent or most deficient. There were no proper sanitary authorities in towns, no trained officers of health in any town or cantonment, and no means whereby the experiences obtained in dealing with sanitary questions at home might be rendered available for India. Until recently, no means on the part of medical officers of receiving education in military hygiene and sanitary knowledge existed; there was no recognition of the sanitary element in the army medical service. There were, up to the latest date of this Report, no means of bringing trained sanitary knowledge or experience to bear on the selection of sites for stations, or on the laying-out of stations or bazaars, with the requisite sanitary works, or on the planning or construction of barracks and hospitals on sanitary principles.

Hill stations.—Hill stations are proposed as a means of being able at once to remove the troops from the influence of climate, malaria, and sanitary defects of stations and barracks on the plains, into a healthy region comparatively. The evidence proves that these stations are useful chiefly for prevention, but not always for the cure of disease; that they are suitable for children, and for healthy or ailing men, but not for unhealthy regiments, especially those suffering from bowel complaints; that about a third part of the troops might be located on hill stations, or on others high and healthy in rotation, with advantage to health; that although the number of stations in

malarious regions should be diminished as far as practicable, and the troops removed to healthier localities, there are certain strategical points, yet undecided, which must be held, whether healthy or unhealthy, and the force on the hills must be considered as a reserve for the purposes of health. Although several excellent hill stations were in use, they were not sufficiently convenient for many stations, and an increased number was required. Very careful examination and trial of the climates of new sites should be undertaken. The evidence further shows that there has been great neglect in sanitary measures at existing hill stations, giving rise to serious disease and mortality.

Elevated plain stations.—Stations on the plains and slopes of India up to 1500 feet, and on the raised coasts of the sea, are comparatively salubrious. They only require adequate sanitary arrangements.

Lowland stations.—Stations on low inundated lands are hotbeds of malaria.

Native lines.—Native lines were laid out and huts built without sufficient reference to health. There was no drainage, clearing, or levelling, and little attention to cleanliness or ventilation. Native hospitals were almost altogether wanting in means of cleanliness or bathing, in water-supply and drainage, in everything, in short, except medicine. The medical officer had no control over the patient's diet. There were no trained attendants on the sick. The evidence shows that, by management and conciliation, much might have been done to improve the sanitary condition of native lines, as well as the state of native hospitals.

General Observations.

1. We have in the course of our inquiries endeavoured to ascertain the probable excess of mortality in the Indian army occasioned by the sanitary defects we have described, as well as the reduction of mortality which would follow on the adoption of improvements in existing stations, combined with the use of hill stations, and the abandonment of as many unhealthy localities as may be practicable.

2. The statistical evidence shows that the mortality varies from $11\frac{1}{2}$ per cent. in the most unhealthy to about 2 per cent.

in the most healthy places, even in their then unimproved state. It has been estimated that the lowest of these rates, or 2 per cent. (double the rate at home stations since the introduction of sanitary improvements), may be taken as the possible mortality under improved sanitary conditions.

3. The annual death-rate for the whole of India was hitherto, or up to 1856, about 69 per 1000. The proposed European establishment at the date mentioned was 73,000 men, and would, at the then existing rate of mortality, require 5037 recruits per annum to fill up the vacancies caused by death alone.

4. A death-rate of 20 per 1000 would require only 1460 recruits per annum; so that the excess of mortality was 3570 lives per annum.

5. Estimating the cost of recruiting, training, and landing men in India at no more than £100 per man, the excess of mortality was equivalent in cost to a tax of nearly £1000 per diem, irrespective of the cost of the extra sickness indicated by a high death-rate.

6. A careful examination of the causes of disease, and of the character of the diseases prevalent at the more healthy stations, would lead us to hope eventually for a greater saving of life than we have here estimated.

7. Causes of disease, such as exist at these stations, would, even at home, be sufficient to account for one-half of the 20 per 1000; and if the time should ever arrive when, under the influence of improved culture, drainage, and sanitary works, India should be freed from the local malaria which exists everywhere there now, as it once did in some form or other over Europe, we may cherish the hope of realising what statistical inquiries appear to point to—namely, that the natural death-rate in times of peace of men of the soldiers' ages in India will be no more than 10 per 1000 per annum.

8. But a reduction of mortality also indicates increased physical strength and greater fitness for duty in the army generally, as well as a smaller proportion of "constantly sick" in hospital; and hence a greater effective numerical strength.

9. Fewer recruits would be required to supply the losses from disease—a point of very great importance, in regard to which Sir A. Tulloch stated that he very much questioned

whether, with the mortality rate of the last forty years, it would be possible to keep up an army of 70,000 men in India. He added that, from what he knew of recruiting, this country would not be able to fill up the gaps occasioned by death, and at the same time supply the vacancies occasioned by invaliding, and by the return of time-expired men.

10. Apart, therefore, from the question of humanity, the introduction of an efficient system of hygiene into India was of essential importance to the interests of the empire.

Recommendations.

1. THAT no recruit be sent to India under twenty-one years of age, nor until he has completed his drill at home; and that recruits be sent direct from home to India, so as to land there early in November.

2. That no spirits be issued to troops on board ship, except on the recommendation of the medical officer in charge.

3. That the sale of spirits in canteens be discontinued, except in specific cases on the recommendation of the medical officer, and only malt liquor or light wines allowed. That the sale of spirits in military bazaars be made illegal, and, as far as practicable, suppressed.

4. That the ration be modified to suit the season; that flannel be introduced as under-clothing; and a better system of supplying boots introduced.

5. That the means of instruction and recreation be extended to meet the requirements of each station. That covered sheds for exercise and gymnastics be provided, and that gymnastic exercises be made a parade. That libraries be improved, a better supply of books and periodicals provided, together with reading-rooms, well lighted at night. That only coffee, tea, and other non-intoxicating drinks be sold to the men at these rooms. That workshops be established; and also soldiers' gardens, in connexion with the station, wherever practicable. That the proposal made by Sir C. Trevelyan, of selecting and educating soldiers of good character for subordinate offices in the administrative department, be tried.

6. That until the mortality be reduced, the period of service in India be limited to ten years.

7. That provision be made for passing at the port of em-

barkation without delay, and for their immediate shipment home.

8. That works of drainage and water-supply be carried out at all stations. That all existing water-sources be subjected to analysis, and those rejected which contain matters injurious to health. That the present method of drawing and distributing water be discontinued wherever practicable. That all water used for drinking purposes be filtered, or otherwise purified.

9. That all future barracks and hospitals be erected on raised basements, with the air circulating under the floors; and that in all existing barracks and hospitals the floors be raised as much as possible, and a free current of air allowed to pass beneath them.

10. That all new barracks be constructed to hold no more than a quarter company in each building, or at most half a company in one building in two separate rooms having no direct communication with each other. That hospitals be constructed in detached pavilions, containing no more than from twenty to twenty-four beds. That future barracks and hospitals be arranged in *échelon*, to receive the benefit of prevailing winds. And that detached cottages be erected for married soldiers.

11. That barracks and hospitals be in future constructed with single verandahs only; and for no more than two rows of beds between their opposite windows.

12. That the cubic space per man in future barracks be from 1000 to 1500 feet, and the superficial area from 80 to 100 square feet, varying according to the airiness of the position. The same space and area to be allotted to existing barracks.

13. That the beds be arranged, with respect to windows, doors, and wall-spaces, so as to ensure the benefit of free ventilation, without exposing the men to draughts. That in existing barracks, where the space between the doors is too small to admit of this, precautions be taken to shelter the beds from draughts. That in all future barracks the wall-space be made sufficient to keep the beds at the least three feet apart, and at the same time out of the door draught.

14. That the ventilation of barracks and hospitals be sufficiently provided for, independently of doors and windows.

15. That in all cavalry barracks saddlery rooms be provided, and saddles removed out of the barrack rooms.

16. That all barracks and hospitals be provided with sufficient glazed window-space to light them, and that they be better lighted at night. Gas to be introduced where practicable.

17. That all barracks be provided with sufficient ablution and bath accommodation, with a constant water-supply. That drinking-fountains, supplied with filtered water, be provided.

18. That barrack cook-houses be improved and better ventilated.

19. That, wherever practicable, iron or earthenware water latrines, supplied with water, and drained to an outlet, be introduced, instead of the present system; and that, where this is impracticable, all cesspits be abolished, and metal or earthenware vessels, to be removed twice a day, substituted. That improved urinals, supplied with a jet for lavatory purposes, as well as with a free supply of water for cleaning and draining the urinals, be provided.

20. On the subject of venereal disease, and the means to be employed for its diminution, we refer to the suggestions made by us under that head in the body of the report.

21. That wherever there is a deficiency of married quarters, the same be supplied.

22. That the cubic space in hospitals be fixed at 1500 feet and upwards, and the superficial area at from 100 to 120 and 130 square feet per bed, according to the healthiness of the position, and that the wall-space per bed be never less than 8 feet. In existing hospitals the same space and area to be allowed.

23. That every hospital be provided with a constant supply of pure filtered water, and with drainage.

24. That every hospital be provided with ablution accommodation, with fixed basins, and with baths, having hot and cold water laid on, conveniently accessible from the wards.

25. That, wherever practicable, waterclosets, with drainage and water-supply, be introduced for hospital wards, and privies converted into water latrines.

26. That the hospital diet-tables in use at home stations be

adopted in India, as far as practicable, and the hospitals supplied with properly trained cooks.

27. That trained hospital attendants be introduced into all hospitals, and that female nurses, under the new medical regulations, be introduced into large general hospitals.

28. That in future every regiment in India shall have an adequate number of hospital orderlies from its own ranks, to provide personal attendance for the sick.

29. That the number of general hospitals in India be increased by the organisation of such hospitals, under the new medical regulations, at the largest European stations.

30. That the strategical points of the country, which must be occupied, be now fixed with special reference to reducing as far as possible the number of unhealthy stations to be occupied.

31. That a sufficient number of hill stations, or of stations on elevated ground, be provided, and that a third part of the force be located on these stations in rotation.

32. That the sanitary duties of regimental, garrison, and inspecting medical officers, prescribed in the new medical regulations of October 7th, 1859, be applied or adopted to all stations in India; and that properly trained army medical officers of health be appointed to this service at the larger stations.

33. The Commission entirely approves of medical candidates* being required to undergo the course of instruction, including military hygiene, at the Army Medical School, and are of opinion that practical training in sanitary science is of the greatest importance to the public service.

34. Considering also the constant reference to sanitary subjects necessary in carrying out public works in India, they consider it requisite that every cadet of engineers should attend a course of sanitary instruction at Chatham.

35. In order to the gradual introduction of sanitary improvements for barracks, hospitals, and stations, as well as in the seats of Government, and throughout towns in close proximity to military stations, they recommend the appointment of commissions of public health, one for each presidency, so constituted as to represent the various elements, civil, military, engineering, sanitary, and medical; to give

* Cadets would be the more proper designation.

advice and assistance in all the matters relating to public health—such as selection of new stations, and sanitary improvement in existing stations and bazaars ; to examine new plans for barracks and hospitals ; to advise on the laying out of stations and bazaars, the sanitary improvement of native towns, prevention and mitigation of epidemic diseases, and generally to exercise a constant oversight on the sanitary condition of the population, European and native ; to report on the prevalence, causes, and means of preventing sickness and disease ; and, further, that administrative measures be adopted to give effect to the advice of the presidency commissions. That trained medical officers of health be appointed, to act in peace as in war, in connexion with these commissions.

36. That, in order to render available for India the experience obtained in dealing with all classes of sanitary questions in England, two officers of the Indian Government be appointed in England, to be associated with the War Office Commission for this special purpose ; unless it should be thought preferable to appoint a similar commission especially for the Indian department.

37. That a code of regulations, embodying the duties and adapted to the specialities of the Indian sanitary service, be drawn up and issued under authority.

38. That the system of army medical statistics at present in use at home stations be extended to all stations in India.

39. That a system of registering deaths and causes of death be established in the large cities of India, and be gradually extended, so as to determine the effects of local causes on the mortality of native as well as of the European population ; the results to be tabulated and published annually by the commissions.

(Signed)

STANLEY,
PROBY CAUTLEY,
J. R. MARTIN,
J. B. GIBSON,
E. H. GREATHED,
WILLIAM FARR,
JOHN SUTHERLAND.

*Summary of the improvements in health of the British Army in
India since 1859.*

So much for the health-history of the British army in India during fifty-seven years. Let us now turn to this most important subject during the short period since 1859: premising that in the Commissioners' Report to the Queen the death-rate of the European forces in India was never spoken of *as a present rate*, excepting as applied to the term 1800-1856; for the actual time present of certain commentators in India and at home (1858-1864) had, of necessity, never come within the range of the Commissioners' inquiries. The mortality given as 69 per 1000 was based on what had been the case during a long series of years. The general and statistical facts in the Report are incontestable; and no commentators were anywhere justified in representing that the Commission stated to be "now" (December 1864) as the death-rate 69 in 1000. Still less were they justified in the use of the phrase "inaccuracy," as to the death-rates laid down by the Commission. The "now" of the Report of the Royal Commission did not refer, and never could have referred, to any years other than those included within their proper inquiries—viz., 1800-1856. This is self-evident; while the "now," the "at present," and the "present rate of mortality" spoken of by the commentators mean really the years 1858-1864, to which the various objectors have referred—years with which the Commission had nothing to do. The discussion, as got up by certain members of the press at home and in India, turned almost wholly upon dates, and upon the unfair application of the word "now." Writers actually attempted to make the Royal Commission answerable for statistics of 1863-64, forgetting that the term of investigation was 1856. The Report states explicitly the years in which the mortality was 69 per 1000; and its "now" applies down only to the year when the meeting of the Commission commenced.

2. It is sometimes the fate of Commissions and of committees of Parliament to see none of their recommendations carried out; but this has not been the fate of the Royal Sanitary Commission for India. As soon as they were appointed, and had sent out to India a series of searching queries—prepared

and printed several months previously even to the first meeting of the Commission, on the 25th November, 1859—to all the principal stations, the public mind everywhere, the authorities, and all classes of official persons, set about abating and removing many of the evils which were soon to be described and published to the official authorities in India. “The forethoughtful query is the *prior* half of the knowledge sought:” so renders Coleridge the saying of Bacon, “*Prudens quæstio dimidium scientiæ.*”

3. The very appointment in England of a Royal Commission, and—almost as presently important—the detailed series of queries, addressed in completeness of matter, order, and arrangement, to officers of the medical department in India, of the corps of engineers, and to officers in command, and circulated through 175 of the principal stations, had necessarily the effect above mentioned.

4. The process of inquiry of the Commission was thus silently but surely working its way through every station in India, military and civil, from May 1859 to May 1863, with the sanitary results which are now being exhibited.

5. Dates are here of importance; and one of the earliest acts of the Commission (May 31st, 1859) was to depute the members specially entrusted with the statistical part of the inquiry to the India House. They were anxious to obtain information down to the latest date; but found, up to the hour of going to print, none later than 1856.

6. The mutiny and its consequent campaigns produced great disturbances in the returns, and some of the records of regiments which had suffered most severely were entirely lost. The publication of the Report to the Queen was delayed until May, 1863, to enable the Commission to include the tardy and scattered returns from India, many of the more important of which never came to hand.

7. It is incredible how much the statistical returns were in arrear down to the time when the Commission sat; but they are now habitually brought down to recent dates.

8. The practical value of all reports is to serve, by comparison, as guides to the future. There is an old saying to the effect that “it is no use crying over spilt milk.” But it is of great use to learn how not to spill any more. This is the great

matter for us now to consider, and we ought never to lose sight of the consideration for a day.

9. For a long time it had been a habit with our military authorities and commanders in the East and West Indies to regard the then existing state of things, including the death-rate, as an inevitable condition of service there. It was the soldier's lot.

10. It is but justice here to observe that such fatalism was at no time shared in by the surgeons of our army in either hemisphere. More than sixty years ago Robert Jackson declared that the British soldier, if placed in the mountains of Jamaica, would share in the condition of health enjoyed by his brethren at home, and the prediction has during more than twenty years been amply verified to the letter.

11. But the prospect was not encouraging when the Commission commenced its inquiries. And as no one doubted the good intentions of the old commanders and military boards, few were so sanguine among old Indians of every class as to expect that the European troops would ever escape from the diseases which had decimated them in the past, whether in the East or the West.

12. Some of the best medical officers, however, always held other opinions; and the Royal Commissioners, looking to the future of India, when sanitary organisation in the army shall be brought to a level with the present state of science, observed, even at the date of the Report, 1863: "The experience of the civil service, of military officers, of their wives and children, of the British troops in many stations, and of the native troops, proves that in the present state of India the mortality of European troops there can be reduced to 20 in 1000."

13. "India," they add, "is undrained; there is no adequate arrangement for the supply of pure water, and malaria pervades nearly the whole country, as it formerly pervaded England. We cherish the hope, however, of realising what statistical inquiries appear to point to—namely, that the natural death-rate in times of peace of men of the soldier's age in India will be no more than 10 per 1000 per annum."

14. The justice of this anticipation was soon proved; for at the end of 1864 this was the state of things: The death-rate was but very recently 69; it is 20 per 1000 per annum.

15. Certain writers, at home and abroad, are now ready to believe that the mortality which, before the inquiry commenced, was held to be inevitable, is now incredible. For this change in public opinion the Royal Commission may, perhaps, claim some degree of credit, as well as for their very practical recommendations.

16. The Commission had the advantage of examining in England, orally, many persons of all the public services, and of the highest authority, upon all questions connected with the East—in all forty-eight witnesses. The Commission thus collected from the most competent persons in India and in England evidence of the sanitary evils to which the British army in India had been exposed; analysed the causes of diseases with the help of science; and suggested what it was conceived more effectual remedies in forty explicit recommendations.

17. They did not conceal from the public—for it would have been contrary to their duty and to English practice—the expense in blood, in suffering, and in treasure, at which England had “held dominion there for a century.” But while it was their principal duty to expose past and still existing abuses, they had the gratification of being able to point out remedies which, in their belief, were likely to prove effective; and thus to hold out the prospect of a higher future for the British soldier in India.

18. “The deaths of the whole European troops in India during the years 1857, ’58, and ’59 have never yet been published; and the Director-General’s second report begins with 1860.”

19. But the great and satisfactory change which came about is the resulting fact of a progressive improvement in the health of the army.

20. The army of Bengal, risen out of the trough of the Ganges, occupied the healthier regions of Oudh and the Punjab; several measures were carried out; new established forms were introduced; and, in conformity with the directions of the Secretary of State for India in Council accompanying the reports of the Royal Commission, a permanent sanitary board was appointed in each presidency.

21. It will assuredly be satisfactory to the public in England

and in India thus to see the predictions of the Commissioners—predictions which at the time appeared somewhat sanguine to their authors—promoted by the governing powers, civil and military, at home and abroad; while it must prove a source of permanent and anxious general interest to demonstrate that, as an assured result of the early and suggestive inquiries transmitted to India by the Royal Commission, followed speedily as these were by a series of most practical sanitary “Recommendations,” an eventual progress has since been established towards a steady fall in the death-rate of British soldiers serving there.

22. I venture to say that whoever in future times would desire to count the gains of the British soldier in India, in habits of life, personal comfort, morals, health, and efficiency, will long refer to the investigations commenced in 1859, when the printed queries of the Royal Commissioners were first read and afterwards acted on throughout the entire of British India, followed soon by great systematic arrangements, as suggested in the Commissioners’ Report to the Queen.

23. It has been seen that the Royal Commission considered, and justly considered, that war formed at all times an actual portion of the normal condition of the Indian army, as of all armies;* and it found, on the most careful inquiry, that during fifty-seven years of this century the mortality of British soldiers had been 69 per 1000 per annum, the high authority of Sir Alexander Tulloch having fixed this annual loss at 70 per 1000. But, keenly alive to the vast improvements in the health and efficiency of the European soldier, through improved sanitary arrangements established during peace, the Commissioners anticipated (paragraphs 12 and 13) that so great a reduction in the annual sacrifice of our white soldiers might be made as should bring it down to “10 per 1000 per annum.” So very great an improvement has not yet been effected, but the Government in India is making annual approaches to it, and following most honourably the high example of the Imperial Government of France in Algeria.

* The annual mortality of 78 British regiments serving in India during the years 1857 to 1860 was at the rate of 77 in 1000.

The annual death-rate of the French army in Algeria in its earlier occupation, and for many years subsequently, was 80 per 1000; while in later years, even including those of military operations, it has been reduced to less than one-sixth, as compared to the early years following the conquest. Reduction in the death-rate has indeed taken place down to 14·48, 13, and even to 10 per 1000 of troops in garrison. This is a great triumph in application of sanitary science, and we hope to see equal if not superior results in all our tropical and semi-tropical possessions. It is believed that in this as in many other great departments of State the memory of Sir John Lawrence will long be held in high estimation.

24. For the following information respecting the improvements in the health of the British army in India since 1859 I am indebted to the kindness of the present Director-General of the Army Medical Department, Dr. Logan. The average strength of the British army in India during the six years 1860-65 inclusive was 63,000, but fluctuated between 57,000 in 1861 and 67,000 in 1863.

25. The admissions into hospital fluctuated, of course, with the strength, irrespectively of other causes; but in the first year of the sexennial period there were 124,000 admissions nearly, and in the last a little over 94,000, which shows a proportionate decrease from 1923 per 1000 to 1505 per 1000 of mean strength.

26. The number of men constantly non-effective from sickness has gradually, although with unequal fluctuations, fallen from 71 per 1000 in 1860 to 59 per 1000 in 1865.

27. The number of deaths has fallen from 2277 in 1860 to 1761 in 1865, or from 35 to 28 per 1000 of mean strength.

28. The number of invalids has somewhat increased, those sent home from India in 1865 being at the rate of 40·9 per 1000 of strength, compared with 39·5 in 1860.

29. The most marked improvement has taken place in the Bengal Presidency, where it has been steady. There the amount of sickness and mortality has come down to be very nearly similar in amount to those in the other presidencies.

30. In 1860 the Bengal army passed through hospital twice, or rather more, while about 40 per 1000 of the mean strength died.

31. By fluctuating amelioration, as we arrive at the last year of the period, one-fourth of this sickness was saved, and also one-third of the mortality. The chief improvements were in the instances of fevers and cholera.

32. *Madras*.—This Presidency did not, on the whole, improve, although it retained its pre-eminence as the healthiest of the three Presidencies. An average of 22 per 1000 has died in the Madras army, without much fluctuation in the several years. Similarly from 1380 to 1400 per 1000 of mean strength passed regularly through hospital. An improvement is traceable in fevers and cholera; but dysentery and diarrhoea have increased in frequency.

33. *Bombay*.—In the western Presidency the admissions have gradually diminished from 1933 per 1000 in 1860 to 1431 in 1865, or to an extent of about one-fourth. The number of deaths fell with fluctuating decrement until 1865, when the deaths, mainly from epidemic cholera, doubled the former average total mortality. In 1860, 32 deaths per 1000 became $18\frac{1}{2}$ in 1864, but rose to 36 per 1000 in 1865.

34. The four great classes of disease which always caused, and still cause, the greatest loss of efficiency and the greatest mortality among Europeans in India—*fevers, dysentery, diarrhoea, cholera, liver diseases*,—may be referred to briefly. While there has been only a slight amelioration in the last—*liver-diseases*,—there is a marked diminution in the other three. While nearly seven-tenths of our men passed through the hospitals with fever in 1860, only a little-over four-tenths of the strength so suffered in 1865. The mortality from fever diminished about one-fourth. As to dysentery and diarrhoea, the admissions during 1865 are one-fourth less than in 1860; while the mortality has fallen to about half of what it was then. Most strikingly the admissions under the head of cholera have been gradually diminishing, until, during the last year of the period, only half as many cases occurred as during the first. We lost also just half as many men from this cause in 1865 as we did in 1860; and the mortality has been constant in its decrease year by year. The curative have not kept pace with the preventive measures in cholera; for the proportion of recoveries to admissions does not appear to have altered.

*Mountain-Climates of India, and their Uses for the British
Garrison-Hill Stations.*

1. OF all the subjects which engaged the attention of the Royal Commission, this has always appeared to me as the most important; and next in consequence must, I fear, be reckoned the disastrous prevalence of syphilis and intemperance in the army, and the means necessary for their prevention. "The proposition has two aspects—1. As regards health; 2. As regards the military occupation of the country. And we must consider it with reference to both of these, in order to estimate its exact value and the extent to which it can be carried into effect."

2. "We are indebted to Sir Ranald Martin for having brought this subject prominently before us, and also for having directed the attention of the Indian Government at home and abroad to its importance."

3. "The *prima facie* evidence derived from the superior healthiness of the inhabitants of elevated plains and mountain regions generally would alone warrant a careful local inquiry into the adaptation of such Indian climates to European constitutions; but, besides this, a large amount of experience has already been obtained in the case of civilians and military officers, who for many years past have been in the habit of resorting to the hills in order to recover from the exhaustion produced by service on the plains."

4. "Similar evidence is afforded by the Lawrence Asylums, one of which, containing 500 children, is at Junnawur, and the other at Mount Aboo. Children are taken in at four or five years, and during their residence they look like English children, while those in the plains below are 'pale, pasty, and wasted.'"

5. "Sir Ranald Martin states that, 'taking any one cause, he should say that the union of heat, moisture, and malaria constitutes the most powerful one in destroying the integrity of the European soldier's health, and conducing to his fall by disease.' And he goes on to state that 'a certain amount of destruction and deterioration of European health must result from a residence at the stations on the plains, even if the soldiers were put into palaces.'"

6. "But while laying this down as a fundamental sanitary principle, he says at the same time that there is a very great difference between the health of the officer and that of the soldier, always in favour of the officer. And there is also a difference between the health of the officer and that of the civilian, always in favour of the civilian."

7. "We have thus three classes of Europeans exposed to the same conditions of heat, moisture, and malaria, presenting three quite distinct rates of sickness and mortality—a fact which indicates the existence of disease operating with different degrees of intensity in each of the three classes."

8. Besides the powerful climatic influences of the plains referred to in my evidence there were many other causes of disease—neglects of military hygiene, public and private, all carefully recorded by the Royal Commission—which went to make up the sum of those evils under which for so long a time the British soldier suffered where we had placed him.

9. The natives of India, early in our career there, saw the supreme value of the mountain ranges to us, and expressed their surprise that we had not used them for the safety of our European soldiers.

10. Hyder Ali, the most able and politic of all the native chiefs who opposed our conquests in the East, felt amazed and was unsparing in his censures when he beheld the English commanders housing their white soldiers on the plains of the south.

11. It is now being understood throughout our West Indian possessions, and even in our African settlements, that the higher grounds are deserving the regard of our rulers, and time only is required to assure beneficent results. The law of climate will everywhere settle the question.

12. Thus, while amongst ourselves in India we have continued a hair-splitting of this question, the direct common sense of the natives has disposed of it.

13. "There is a convent at Darjeeling, with 11 adults and 28 children sent up from the plains. During thirteen years there had been no death amongst the children; while the mortality amongst the children in Bengal was 84 per 1000 per annum."

14. "As, of all subjects, children are the most susceptible

to sanitary defects of any kind, this experience proves that these hill stations are not necessarily unhealthy, and, if found so for grown men in health, the cause lies elsewhere than in the climate."

15. "It may fairly be taken for granted that properly selected hill stations, under proper sanitary management, would be of great advantage to the health of the army; and we propose, therefore, to confine our attention chiefly to those points in the selection which have been brought before us in evidence. Indeed, Sir Ranald Martin, while strongly advocating the adoption of hill stations, states that the whole subject has to be investigated *ab initio*, both as regards 'the mountain ranges' and 'the climates most suited to the occupation of Europeans.'"

16. So far back as August, 1857, seeing what must in future be the true garrison of India, I submitted the original suggestion, and proposed the plan for investigating in full detail the entire question of the climate of the mountain ranges throughout India; and it met with the active support of the Court of Directors, and of the Minister of War, Lord Panmure. But the then Governor-General of India, Lord Canning—a man always slow in action,—allowed the matter to pass by.

17. "The stations which have hitherto been selected as hill sanatoria are of two classes: those on the spurs of the Himalayas, chiefly occupying elevated and narrow crests; and those on the table-lands of Southern India. There is another class of which there are only one or two examples—viz., isolated mountains, such as Mount Aboo and Ramandroog,"—islands on the plains, as I would designate them.

18. "The least elevated of the Himalaya stations is Saba-thoo, 4000 feet above the level of the sea. The Southern Indian stations vary from 5000 to upwards of 7000 feet in height. Mount Aboo has an elevation of upwards of 4000 feet, and Ramandroog of 3000 feet."

19. "The majority of the stations being on the outer part of the mountain ranges, and at an elevation where the heaviest rains occur, receive the first impact of the monsoon, and the consequence is that they are all wet, and subject to cold fogs."

20. "The annual rainfall in the Himalaya stations varies from 70 inches to 132 inches, as at Darjeeling. The rainfall at

Mahabuleshwur, in Bombay, is actually 240 inches per annum. In the Neilgherry group, which are not exposed to the monsoon, the rainfall is from 50 to 60 inches a year."

21. At Charapoonjee, in Assam—a station chosen, like many others, without any care, or by accident,—the rainfall is counted by fathoms. This mountain range is in front, and bears thus the brunt of the S.W. monsoon during every rainy season. The station proved, of course, a complete failure as a sanitarium; but in the device of it, and in the sanitary results, it offers not an unfair view of the average care and the intelligence hitherto employed in this matter. Counted by inches, the rainfall on this ridge was, in 1851, 592, or $8\frac{1}{4}$ fathoms of water; while some 30 miles in its rear the rainfall is quite temperate.

22. "The mean temperature varies, of course, with the latitude and elevation. In the Himalaya group, the highest mean is from 64° to 78° ; in the Neilgherries, from 63° to 70° . The lowest mean in the Himalayas is from 35° to 42° ; the lowest in the Neilgherries is from 53° to 60° ."

23. "We have the mortality returns for hill stations for a few years only, and they throw but imperfect light on their influence on health;" the fact being that here, as in the selection and the sanitary arrangements of hill stations, all was mismanagement and neglect. Regiments exhausted by the diseases of the plains, and invalids suffering from chronic diseases contracted there, were crowded upon mountain tops; unsuitable cases were sent to unsuitable stations, and persons wondered at the evil results!

24. By excluding deaths from endemic diseases—diseases imported from the plains—a low rate of mortality was presented in returns from certain hill stations; and in Sabathoo the mortality was 15, in Dugshai 28 per 1000 in the year 1860. But, as already stated, no conclusions as regards health, disease, or mortality, can be drawn from observations extending over short periods.

25. It is difficult to say which has caused the most injury to the soldier's health—the ill selection of hill stations, or the sanitary mismanagement of them when occupied. The ravines at Simla were described by one observer as emitting "effluvia as strong as on going into a sewer"; while the water-supply

there was "scanty and liable to pollution." There was, indeed, at most of those stations, every kind of sanitary neglect.

26. "The authorities," says Surgeon-Major Alex. Grant, "seemed to think that, because the climate was cold, the men might be crowded together and all sanitary arrangements neglected with impunity."

27. At the station of Murree, 7000 feet high, epidemic cholera appeared—a rare occurrence, comparatively, on the mountain ranges. "There was nobody else sick but the soldiers," says Sir John Lawrence; and the Commissioners add—"Not one officer suffered—a clear proof that the men were exposed to some specially unfavourable condition."

28. On a careful review of this question, and after many years' experience, I am firmly of the opinion which I expressed in evidence before the Commission—that in well-chosen and well-ordered hill stations the British garrison of India can alone find security of health, and that every soldier who can be spared from the duties of the plains should be placed there, the mounted branches occupying the various table-lands.

a. That such stations as must be held on the plains should consist of open field-works, and not walled fortresses; and that their European garrisons be reduced to a minimum, to be exchanged every year by fresh troops from the mountains.

b. That the climates of the mountain-ranges throughout India shall be used mainly for the prevention of disease and the preservation of the health of the soldier, their value being small, comparatively, in the cure of disease.

c. That newly arrived British troops be always sent to the nearest hill station.

d. That the British forces stationed on the hills throughout India shall be made to descend upon the plains every cold season, with the view to perfect them in the march and other exercises, as well as in the fire.

29. The Commission, in its report to the Queen, arrived at the following conclusions:—

a. "The result of our inquiry into the important subject of hill stations may be given in a very few words, as follows:—

b. "To reduce to a minimum the strategic points on the alluvial plains, and to hold in force as few unhealthy stations as possible.

c. "To locate a third part of the force required to hold these points on the nearest convenient hill station or elevated plain, including in this third, by preference, men whose constitutions are becoming enfeebled, and recruits on their first arrival; and to give the other two-thirds their turn.

d. "Never to trust to simple elevation as a means of protecting health; but, while occupying the best available elevated stations, to place these (for they want it just as much as the stations in the plains) in the very best sanitary condition."

[*Note.*—I have said that, besides climatic influences, a vast array of neglects of every kind, in matters concerning mental and bodily health, had combined in grievous measure to injure the physical energies, and eventually to destroy the life, of the British soldier in India. It was to inquire into the causes of such unnatural evils, and to suggest means for their prevention, that a Royal Commission was at length deemed necessary by the British Government.]

Postscript on the Mountain Climates.

1. The English in India, in common with the Dutch in the Eastern islands, holding commerce as the pole-star of their policy, confined their garrisons of old naturally to harbours and the embouchures of rivers, upon which they generally planted their settlements. But, after more than a century of extending occupation and experiences, the British Government—true to its character, as presented by our greatest military historian, of being always warlike but never military—continued to place its white soldiers on the plains, the seats of trade and the nurseries of our revenues, regardless of the ever present physical degradation of our battalions, the result of exposure to heat, moisture, and malaria, and of indulgence in habits altogether unsuited to an unnatural climate.

2. When our dominions had reached to imperial dimensions, and mountain ranges crossed our path, we turned them, and still stuck fast by our native habitual purposes and by the level country.

3. Viewing the map of Hindoostan from north-west to south-east, from Peshawur to Burmah, over an enormous ex-

tent of kingdoms differing exceedingly in their natural and physical circumstances, we find a climate, generally speaking, that gives a surprising energy to the soil of the plains, which it denies to their inhabitants; while we perceive, at the same time, that wherever there exists an important station or cantonment, we possess, more or less distant, and as if by design, ranges of mountains more or less elevated, and more or less suited to what ought to be our main object and purpose—namely, protection from tropical heats and their consequences upon the stranger Europeans: stations, in eastern phrase, where the warmth is not heat, where the coolness is not cold.

4. Though an army surgeon, and desirous to confine myself solely to the strict duties of my profession, I ventured to submit, in my evidence before the Royal Commission appointed in May, 1857, to inquire into the sanitary condition of the British army, on my knowledge and experience of the wants of the European army in India, that the removal of a large portion of the British garrison there—of all, indeed, who could be spared from the necessary duties on the plains—to the elevated ranges and cool climates throughout our Eastern possessions had become what I ventured to term “a State necessity;”—a necessity which must ere long demand a more extended State intervention.

5. This paramount consideration was forced on my attention the moment the mutiny of the Bengal native army was announced in this country. It then became apparent that, for the future, the possession of India must be maintained by the white hand which, in the main, had won it; and, convinced of this truth, so early as August, 1857, I presented, as stated, a letter to the chairman of the Court of Directors, followed by another dated December of the same year, suggesting that the elevated grounds within our possessions in the East should be carefully examined with the view to their occupation by our European garrison. The first letter contained suggestions for the examination and selection of special localities in the mountains; while the second specified such matters for examination and report as should best fix the attention of the civil and military authorities. I will only here observe that a matter of such obvious necessity must, sooner or later, engage the public attention.

6. One of the most sagacious of the native princes who have made war upon us in India was Hyder Ali, the founder of the modern kingdom of Mysore, and father of Tippoo Sultan. His notion of treating the European soldier was to place him on the high, cool regions; and thence to convey him in doolies into the plains, ready to be let slip on his enemies at the moment of action.

7. The late Major-General Sir Mark Cubbon, for many years Commissioner of Mysore, stated officially that a general belief prevails amongst all the more intelligent natives throughout India, that until the British forces are placed in military occupation of the mountain ranges our possession of the empire cannot be secure.

8. The first active field services on which I had been employed in India were in the hill provinces of Orissa and Gondwana. The ranges were of low elevation, and their climates were pestilential to an extreme degree, even for India. The native troops and their European officers suffered most severely from malarious fevers of the worst character; the casualties were excessive.

9. It happened thus that very early in my career the questions of the influence of locality on the plains, on low-hill ranges, and on the higher mountain regions came under my personal and anxious observation; while severe personal suffering, and an after-experience during the disastrous campaigns in Ava, in the first Burmese war, tended more seriously still to impress upon me the power for evil of external causes in the production of disease in armies.

10. It is true that in Burmah, besides the malarious influences in their peculiar and local forms, associated with an unusual amount of humidity even in the East, we had to contend with every kind of privation in diet, tent covering, and clothing. In addition to these disadvantages, active field operations were carried on in the rainy seasons, which far exceeded in violence and duration anything existing on the continent of India, where camp movements are prohibited by nature during heavy rains.

11. Here, in fact, the British soldier summed up the catalogue of his old proverbial neglects by the authorities of the State; and the result was a loss to the army of 73 per 1000 of

strength in the two campaigns—a loss, I believe, unsurpassed even in our fatal military records.

12. These were indeed lessons of deep import to every reflecting officer, however young or of whatever branch of the service. When it was objected to the great Napoleon, by the member of the Committee of Public Safety, Aubry, that he was too young for promotion, he replied: “*On vieillit vite sur les champs de bataille.*” And so it is and must be whenever we have to contemplate a constant large loss of life, as in wars and revolutions, even during brief periods. We then looked upon eighteen months as a very long time; and we all felt, even the youngest or most heedless of us, the older for our brief experiences. I can say that I felt the older for one night of a disastrous shipwreck on the coast of Pegu, when proceeding with the Bengal Body-Guard on the very expedition here spoken of. Experiences such as these, when we count our lives by seconds, raise the most ordinary persons superior to the selfish considerations which disturb men in the accidents of life, whether civil or military—considerations usually termed fear. This privilege is largely shared by the army surgeon in common with the executive officer.

13. But to return to our subject. The having been employed on so many occasions in countries of exceeding unhealthiness caused me, in my earliest reports on public health in India, to offer for the attention of the State authorities the advantages of the higher grounds for occupation by the British soldier. In this I but followed in the East the footsteps of Robert Jackson, the incomparable military physician, while treating long ago of the West Indies: “The choice of a proper position for the establishment of quarters,” he says, “is not obscure or difficult. It is known to the scientific by a view of locality, and to the ignorant by experience.”

14. When, after half a century of hesitation and of neglect, Jackson’s plan was at length carried out in Jamaica, the result was a reduction of a mortality of British soldiers of from 147 and 130 per 1000 to about 22 per 1000 per annum.

15. Once in the mountains of the East the British soldier would feel himself no longer in India, even while yet within a few hours’ journey of its plains. He could in the high lands

labour, too, in the open air with less injury or fatigue than in the Cape or the Australian settlements.

16. Dr. Hooker says of Darjeeling, that "its climate cannot be exaggerated for healthiness, when compared with the plains of India;" while Mr. Hodgson, late Resident in Nipal, says of the central elevation of the Himalaya, "For months the thermometer hardly ranges 50° day or night, and that about "temperate" of Fahrenheit, or the perfection of temperature; and altogether the climate is one of the safest and most enjoyable in the world." Dr. MacCosh, speaking of the hill district of Kumaon, says: "The elevation above the sea is 5000 to 6000 feet, with a climate and vegetation almost European, and a residence here makes one forget he is in India."

18. A general observation of much interest occurs here. Montesquieu and other philosophers have observed that the condition of India, with its frequent military revolutions, were indeed the result of climate and of physical necessity—the *absence of a temperate zone*; that the conquerors inhabited the surrounding high grounds, and the slaves and the cowards occupied the plains; and therefore the continued immigration of the one, and the conquest by them, was a physical necessity derived from climate. If the law of nature be such as is here indicated, our course of action is clearly marked out for us. To use Jackson's words, it is neither obscure nor difficult.

19. I have long been impressed with the conviction that nothing short of a proved necessity can warrant the placing of any very large portion of the British garrison on the hot and pestilential plains of India. I further believe that doing so is unnecessary in a military sense, inasmuch as native troops can perform the duties of the plains in a very effective manner.

20. Hitherto, under the ramparts of our old forts and in our badly-selected and ill-arranged stations and open cantonments, our men have sunk away at the well-known rate already mentioned. By reducing our garrisons on the plains to their minimum; by placing them in field-works open to the winds, in stations of proved salubrity comparatively; by relieving them at the end of every year, and removing them for mental and bodily refreshment and invigoration back to the

high grounds, I venture to say that their health and contentment might be preserved.

21. By such arrangements we should meet the material wants of the case, involving only a pure and cool air, together with the means of exercise and amusement—beneficent objects to be secured and promoted on every ground of sound policy. Comparing the hill stations to open cantonments on the plains, I think the former may be made of avail to the medical police of the army, by rendering the admission of syphilis and of the poisonous fermented liquors of the bazaars greatly more difficult. A mountain, and especially one that is detached, will not, as in the other case, be open to a ready approach from all points of the compass. It is unnecessary to insist on the importance of this consideration.

22. In order to render military exercises conducive to health and efficiency, our battalions may be brought down upon the plains every cold season, there to be perfected in the march and the fire—the two requisites which, according to Marshal Ney, go to make a thorough and complete soldier. Thus our garrisons would make their periodical appearance before the races of the East, possessed of their native qualities, unaffected by unnatural climates. These facts and circumstances I venture to state here, though neither a soldier nor statesman by profession.

23. In the Statistical, Sanitary, and Medical Reports of the Army Medical Department, published annually, we find the following notices of some of the hill stations:—

Darjeeling.—Assist.-Surgeon Kidd: “Among the European residents there may be said to be no epidemic disease. The records of the hospital furnish no evidence of there ever having been any epidemics among the troops.”

24. *Nynce Tâl*.—Dr. Pinkerton gives distinct expression to his favourable view of this climate, combating the implication that hill stations are little more than prophylactic in the management of Europeans. To secure great advantages, even to invalids, he regards good accommodation and other sanitary conditions as all that can be needed.

25. *Landour*.—Surgeon-Major Stewart regards “this climate, as a whole, delightful, and the various seasons remarkably equable. Permanent residents in these hills seem as healthy

as the same class in England; and, from considerable experience in the climate, I would insure a man's life *at a lower premium* than in most parts of the United Kingdom. The very healthy appearance of European children has often been remarked, and during four years there were no deaths amongst the pupils of a school numbering about a hundred boys and about fifty girls."

26. *Murree, Punjab*.—Assistant-Surgeon Read: "Few diseases are indigenous to the climate of Murree, almost all that are met with being imported from the plains." Quotations to the above effect might be multiplied, but it seems unnecessary.

27. Dr. Beatson, the distinguished Inspector-General of Hospitals, reporting to the Commander-in-Chief in India, in July, 1864, on the general question of recourse to the mountain ranges throughout the three Presidencies, says: "If the health of the large army of British troops now in this country is to be maintained, and the efficiency of the force preserved, a large proportion of it must be located on the hills."

28. "As to the composition of the force to be thus located on the hills, my opinion is most decidedly in favour of entire regiments, instead of composite battalions; an opinion in which, in a military point of view, I feel certain that every military man will coincide. By sending regiments to the hills they will change their locality and better their climate; their institutions accompany them, and everything else remains the same."

29. "Sir Ranald Martin, than whom no one has more earnestly weighed and studied this question of hill climates, most forcibly and truly remarks that 'all the known experiences tend to the conclusion that a residence in the temperate mountain regions of India, while preserving our men from sickness, would render them less susceptible to the heat of the plains;' and he continues—'The contrary supposition of all this would indeed go to prove that the keeping men in good health in the first instance tends only to make them sickly afterwards, and that men rendered sickly in the plains of India must become less sickly by being made to continue there.' This latter, however, absurd as it is, is really the supposition involved in the theory of acclimation."

30. This very able staff officer adds—"That a British regi-

ment can be kept in health and physical—which is only another word for military—efficiency during ten continuous years' residence in the plains I do not believe; and I have formed this opinion after nearly twenty years' experience with British soldiers in Ceylon, Pegu, and India." Half the time has, indeed, been sufficient to ruin many a fine corps.

31. Through the kindness of the Director-General, Dr. Logan, I have been supplied with the following information on the influence of the mountain climates of India on the health of British soldiers, reckoning from 1859. The returns having reference to hill stations in India are such that it is impossible to collect any just idea of their comparative healthiness in successive years of the period under consideration.

32. At only four of them are battalions, or portions of regiments, stationed for any number of months continuously in any one year; and the health-statistics of such corps or detachments are very much mixed up with those of the periods passed in the plains during the year. Or, if the hill-statistics are to be separately considered, the returns deal not only with the doing-duty men, but they combine with these the constantly fluctuating population of sick and convalescents, many of whom go up in a dying state, and others, when sinking, are sent back to the plains to try the warmer climate ere they die or are invalided.

33. The hill stations here to be referred to are—Sabathoo, Dugshâi, Jakatalla, and, more recently, Kussowlee.

34. At Sabathoo in 1860 the mortality was 15, and at Dugshâi 28, per 1000; while the admissions were 1600 per 1000 at the former, and 1200 at the latter station. At Jakatalla the admissions were 774, and the deaths 21, per 1000.

35. At Sabathoo in 1861 the admissions were 1542, and the mortality 26, per 1000; while at Dugshâi only 513 per 1000 went into hospital, and $6\frac{1}{2}$ died. At Jakatalla 534 and 20 were the ratios per 1000 of admissions and deaths respectively.

35. In 1862 the 2nd battalion of the Rifle Brigade occupied Sabathoo for the whole year. They admitted at the rate of 1028 per 1000, while $12\frac{1}{2}$ per 1000 of strength died. The 42nd Highland Regiment were nine months at Dugshâi, but the figures are vitiated by a three months' stay at Umballa in the same year.

36. In 1863, at Sabathoo, 825 per 1000 were admitted, and 28 per 1000 died. At Dugshâi the admissions and deaths were at the rate of 769 and 20. At Jakatalla, 1443 and 20 were admitted and died per 1000 respectively.

37. In 1864, the 42nd Regiment spent eight months and a half at Dugshâi, and the 82nd Regiment remained nine months at Sabathoo, with almost similar results. At Jakatalla, 1631 and 13·18 were admitted and died per 1000 respectively.

38. In 1865, the last year of the period here recorded, the Dugshâi admissions were 1104 and the deaths 15 per 1000. At Sabathoo they were 1683 and 4 respectively. At Jakatalla, 1589 and 16½ were admitted and died per 1000 respectively.

39. To sum up. In the only three stations where an approach to comparative statistics is possible, the combined mortality had fallen from 21 to 12 per 1000; while admissions seem to have increased from 1208 to 1459 per 1000 of mean strength. The figures are no doubt fallacious, as bearing on the improvement of the health of British troops at hill stations.

[*Note.*—There are many important matters to be looked to, in continuation of the great sanitary improvements recently instituted throughout India by the administration of Sir John Lawrence; and the further actions of the Government, at home and abroad, will, it is hoped, be directed with increasing energy to the vast questions of the mountains in the three Presidencies, and to the prevention of syphilis and intemperance in the army. As to the proposal which I have ventured to submit for consideration by the profession, of having health returns added to the statistics of the army, it must be left to be settled for or against by the masters of method and of numerical arrangement. I have, meanwhile, a strong impression of their usefulness, and that something of the kind is required, and that it ought to be done.]

For the following valuable Tables I am indebted to my friend Dr. Graham Balfour, of the Statistical Department, Army Medical Board.

N.B.—Burmah is included with the Madras Presidency, and Aden with that of Bombay.

RATIO PER 1000 OF MEAN STRENGTH.					
	Admitted into Hospital.	Died.*	Sent home as Invalids.	Discharged at Netley as Invalids.	Constantly non-effective from Sickness.
1860	1923	35.36	39.52	10.0	71.35
1861	1789	36.74	30.66	15.0	74.89
1862	1736	25.66	28.17	18.8	68.01
1863	1634	23.64	34.39	20.2	62.63
1864	1530	21.93	37.51	17.0	59.31
1865	1505	28.14	40.87	20.5	58.91

* Includes the deaths of invalids on their passage home, or while awaiting their discharge after arrival in England.

RATIO PER 1000 OF MEAN STRENGTH.								
	By Fevers.		By Dysentery and Diarrhœa.		By Cholera.		By Hepatitis.	
	Admitted.	Died.	Admitted.	Died.	Admitted.	Died.	Admitted.	Died.
1860	683.6	4.62	200.8	6.27	18.9	10.39	66.3	3.43
1861	668.5	3.47	105.8	4.80	27.0	16.54	57.5	2.68
1862	650.6	2.90	146.6	3.23	10.8	6.65	56.6	2.76
1863	579.1	2.61	129.6	3.12	5.4	3.14	60.5	2.37
1864	444.7	2.78	132.4	2.49	4.0	2.58	53.7	2.46
1865	436.0	3.39	154.6	3.31	8.6	5.43	60.3	3.13

In this table only the deaths *in* India are included.

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